Infant Feeding Practices and Growth at 2 years old in the Birth-To-Twenty cohort

By

Jenna Snoyman (Student no: 0703972N)

RESEARCH REPORT

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SUPERVISOR: Dr Rihlat Said Mohamed

Development Pathways for Health Research Unit,

School of Paediatrics and Child Health,

Faculty of Health Sciences

University of the Witwatersrand

Declaration

I, Jenna Snoyman, hereby declare that this research report is my own original work. It is being submitted for partial fulfilment of the requirements for the degree of Masters of Science in Medicine: Child Health (Neurodevelopment) at the University of the Witwatersrand, Johannesburg. It has not been submitted entirely or partially for any other degree or examination at this or any other University.

Signature:_____

Date:_____

Dedication

My deepest thanks and appreciation are extended to

My husband Sascha, and my parents Jeffrey and Beryl. Without your love, support and sacrifice I would not have been able to accomplish this dream.

To my faithful companions Lulu and Zara, for staying by my side and keeping me company all those long hours

I dedicate this work to you.

Abstract

Introduction: The WHO (World Health Organization) (2008) stated that infant and young child feeding practices directly affect the nutritional status of children of two years of age and under. Two fundamental stages in child development are the prenatal period and the first two years after birth - the so called "first 1000 days of life". During that stage of development, rapid growth will occur; however any nutritional deprivation experienced may cause perpetual damage to the child for the rest of the child's life. Growth is used globally as an indicator of a child's wellness and is associated with their survival rate. Placing focus on and improving infant and young child feeding practices in this age group of children, is vital to promote growth, health and development (WHO, 2008). Wasting exists in South Africa at a low prevalence and stunting persists and is at a prevalence of 26% in children under 3 years of age (Shisana et al., 2013). Breastfeeding practices in South Africa are also known not to be at an optimal level. Though there is a large amount of literature on infant feeding practices in the context of the PTMCT (Prevention of Mother-To-Child Transmission), there are only a few publications that have described the association between infant feeding practices and growth during infancy. Furthermore the lack of historical information on infant feeding practices hinder the possibility to assess how infant feeding practices and its relation to infant growth, have changed since the Integrated Nutrition Program that was put in to place in 1995.

Aim: This study aims to determine the association between infant feeding practices and growth at 1 and 2 years of age in the Birth to Twenty Cohort in 1990-1992.

Method: The study is a secondary analysis study using data from the prospective Birth to Twenty cohort study which included 3273 children. The exposure variables in this study were infant feeding practices at 1 and 2 years (infants ever breastfed, duration of breastfeeding and age at introduction of solid and semi solid foods). The exposure variables were growth at 1 and 2 years (HAZ (Height-for-Age Z–score), WHZ (Weight-for-Height Z-score), stunting and wasting). Covariates associated with child growth were included in the analysis: household socio economic status, household water access, household density, maternal education, child health and disease status, ethnicity, parity, birth weight and gestational age. Multilinear regressions were used to assess whether the association between infant feeding practices and growth remains after adjusting for the covariates.

Results: The primary Birth to Twenty study had more than 35% loss to follow up at 18 years. Participants included in the statistical sample were compared to participants excluded from the analytical sample according to their demographic data and birth characteristics. The two samples differed in their ethnic composition ($p<0.001$), their quality of access to water facilities ($p<0.01$, level of maternal education ($p<0.00$) and gestational age ($p<0.03$). In this study, 97.3% of infants were ever breastfed, the mean duration of breastfeeding was 11.6 months and the mean age at introduction of solid and semi-solid foods was 3.6 months. The prevalence of stunting at 1 and 2 years was 8.4 % and 20.5% respectively. The prevalence of wasting at 1 and 2 years was 2.2% and 4.8% respectively. A month's increase in duration of breastfeeding was associated with a decrease in HAZ by 0.01 and 0.02 z-score at one and two years respectively. A month's increase in the duration of breastfeeding was associated with an increase in stunting. No statistically significant associations were seen between the other infant feeding variables and growth indices (ever breastfed, WHZ, and wasting).

Conclusion: A negative association was observed between duration of breastfeeding and HAZ at one and two years. This study contributes to other studies that noted this association without accounting for the quality of complementary feeds given during the duration of breastfeeding. This information provides a baseline form of evidence and information against which current infant feeding practices and growth can be compared to.

Keywords: infant feeding practices, growth, breastfeeding, complementary feeds, stunting, wasting, South Africa.

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Abbreviations

BMI	- Body Mass Index
BT20	- Birth to Twenty
HAZ	- Height-for-Age Z score
HIV/AIDS	- Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
LAZ	- Length-for-Age Z-score
PMTCT	- Prevention of Mother-To-Child Transmission
SANHANES-1	- South African National Health and Nutrition Examination Survey
UNICEF	- The United Nation's Children Fund
WHO	- World Health Organization
WHZ	- Weight-for-Height Z score
SES	- Socio-economic Status

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1. Introduction

1.1 Background

In 2008, the UNICEF (United Nation's Children Fund) described a conceptual framework that helps to describe the causal factors associated with early child undernutrition. It first describes immediate causes that operate at the individual level, which includes feeding practices or inadequate dietary intake and diseases. The framework then goes on to describe underlying causes at the household and community level, which includes socio-demographic factors, poverty and inadequate access to health care services. Basic causes that include the structure and processes of society were also pointed out. These include socio-economic and political factors.

The WHO (2008) stated that infant and young child feeding practices directly affect the physical growth of children of two years of age and under. Two fundamental stages in child development are the prenatal period and the first two years after birth - the so called "first 1000 days of life". During those stages of development, rapid physical growth and development will occur; however any nutritional deprivation experienced may cause perpetual damage to the child and for the rest of the child's life (Tomlinson and Landman, 2007). "Child's growth is the most widely used indicator of nutritional status and it is internationally recognised as an important public health indicator for monitoring health in populations" (Blossner, 2006: 145). Growth is used globally as an indicator of a child's wellness and is associated with their survival rate (Cameron et al., 1998). Placing focus on and improving infant and young child feeding practices in this age group of children, is vital to promote child physical growth, health and development (WHO, 2008). Results from a study by Adair and colleagues (2013), showed that in fact putting interventions into place to increase birthweight and physical linear growth during the first two years of life is likely to result in gains in height and schooling and prevent the development of adult chronic disease.

Stunting and wasting in children are two forms of undernutrition that reflect physical growth faltering and nutritional status. Stunting indicates slowed linear growth that is associated with growing up in low income household, poor maternal education, poor child care practice and repeated exposure to severe infectious diseases in early childhood (such as measles, diarrhoea, pneumonia, meningitis and malaria (Black et al., 2013). A child is diagnosed as

stunted when his/her child height-for-age (HAZ) is below -2 z-score of the median of the WHO Child Growth Standards (UNICEF, 2013). Wasting rather reflects acute undernutrition and is diagnosed in a child when his/her weight-for-height (WHZ) is below -2 z-scores of the median of the WHO Child Growth Standards (UNICEF, 2013).

Stunting causes short term effects in the young child such as poor physical and cognitive development (Black et al., 2013). In the long term, it is also associated with poor health outcomes such as obesity, hypertension, and type 2 diabetes later in life (Barker, 1997; Victora et al., 2008; Adair et al,. 2013). Globally, in 2011, 165 million children under-5 years of age were stunted (Black et al., 2013). East and West Africa and south-central Asia have the highest prevalence of stunting with a prevalence of 35.6% or 56 million in Africa and 26.8% or 95.8 million in Asia (WHO, 2008).

Children who are wasted are at an increased risk of mortality (WHO, 2008). Globally, the prevalence of wasting in children less than 5 years old decreased by only 11% from 1990 to 2011, from an estimated 58 million children to 52 million children (WHO, 2012). The highest prevalence of wasting was seen in South Asia, with 16% of children moderately or severely wasted (WHO, 2008). In Sub-Saharan Africa, 9% of children were wasted in 2011, showing a 10% decrease in prevalence since 1990. However, due to rapid population growth in Sub-Saharan Africa, the area now presents with more than a third of children presenting with wasting (WHO, 2008).

In that regard, the United Nations Sustainable Development Goals on Zero Hunger aim, by the year 2030, to end all forms of malnutrition, including achieving the internationally agreed targets on stunting and wasting in children under five years of age and to address the nutritional needs of women of child bearing age, pregnant and lactating women (United Nations, 2015). The 2012 WHO Global Targets for Maternal, Infant and young Child Nutrition has set a goal to reduce by 40%, the global number of children under 5 years of age who are stunted by the year 2025 (WHO, 2012). These two goals follow the Millennium Development Goal related to reducing the prevalence of underweight children, (WHO, 2012). In terms of infant and young child feeding practices for optimal child growth, it is currently recommended to promote (1) breastfeeding initiation within one hour after birth, (2) exclusive breastfeeding for the first 6 months of life and (3) continued breastfeeding up to the age of 2 and beyond, together with safe, age appropriate feeding of solid, semi-solid and soft

food starting at 6 months of age (UNICEF, 2013). Interventions to improve maternal nutrition have also been outlined as a strategy to reduce the prevalence of stunting and wasting. This will in turn improve foetal growth, reduce the prevalence of low birth weight and hence improve child growth and development. (UNICEF, 2013).

In Africa, the prevalence of stunting was at 38% in 2010, and has not shown a substantial decrease, due to population growth and little improvement is anticipated in future years (WHO 2012). Sub-Saharan Africa is reported to have had an increase in the prevalence of stunting in children less than 5 years of age until the mid-1900s; and subsequently a modest reduction in the prevalence (Stevens et al., 2012). With an increase in population size in Africa, this region is the only region with an increase in the number of stunted children in the past 10 years (Stevens et al., 2012). These numbers indicate that there is an urgent need to assess infant feeding practices in order to improve infant and young child growth patterns.

In South Africa, a recent review of current literature has discussed that stunting has been persistent in children under the age of 3 years old between 20 and 30% in the last 20 years (Said-Mohamed et al., 2015). In addition, according to SANHANES-1 (South African National Health and Nutrition Examination Survey), the prevalence of stunting among 1-3 years olds showed an increase by 11.7% between 2005 and 2013 (Shisana et al., 2013). Severe stunting in the age group 0-3 years increased by 32.6% between 2005 and 2013 (Shisana et al., 2013). This evidence further highlights the need to investigate child feeding practices during the first 2 years of life in South Africa (Said-Mohamed et al., 2015).

1.2 Literature Review

1.2.1 Infant feeding practices: definitions and situation in SA

WHO (2008) recently defined several mode of infant feeding practices during the first year of life: *(1) Exclusive breastfeeding* where infants receive only breast milk (directly from the mother, expressed breast milk or wet nurse); *(2) Predominant breastfeeding* where infants predominantly receive breast milk (expressed or from a wet nurse) but may also receive water or water based drinks and fruit juice; *(3) Breastfeeding* where infants receive breast milk, as well as any food or liquid (non-human milk and formula); *(4) Bottle-Feeding* where infants receive any liquid or semi-solid food from a bottle with a nipple or teat, and *(5) Complementary Feeding* where infants receives milk and semi-solid or solid foods.

Globally less than 50% of infants are breastfed within the first hour of life, however this is said to be higher in least developed countries (52% in 2011), the region with highest rate being Sub-Saharan Africa (UNICEF, 2013). In 2011, the global estimate for duration of exclusive breastfeeding was less than 6 months, with continued breastfeeding until age 1 year at 76% (UNICEF, 2013). Southern Africa was amongst the region was the highest rate (52%) of exclusive breastfeeding in infants under 6 months old compared to other regions such as in West and Central Africa (25 %) (UNICEF, 2013).

The UNICEF (2009) reported that only 7% of children under 6 months were exclusively breastfed despite the fact that 88% of mothers initiate breastfeeding soon after birth (UNICEF, 2009). Exclusive breastfeeding between 0-5 months was as low as 8.3 % and continued breastfeeding at 12 and 23 months was 73.7% and 30.6% respectively (Victora et al., 2016).

A study by Zollner and Carlier (1993) was conducted on breastfeeding and weaning practices in rural region of Venda in 1990. The study found that almost all the children under the age of 2 years old were being breastfed however 58% of infants under 3 months old were receiving complementary foods and 40% of infants under 3 months old received carbohydrates on a daily basis; this increased to 95% between 3 and 5 months old (Zollner and Carlier, 1993).

A study by Delport, Becker & Bergh (1997), on growth, feeding practices and infections in Black infants, was conducted at Kalafong Hospital Pretoria and consisted of a majority of infants from urban and rural economically disadvantaged communities. The study found breastfeeding was initiated in all of the infants (Delport, Becker and Bergh, 1997). At 1 month old 95% of infants were breastfed, with remainder of infants either receiving formula only or formula and breastmilk; at 3 months old the prevalence of breastfeeding was at 90% and at 9 months old the prevalence of breastfeeding dropped to 81%, which remained the same at 12 and 15 months (Delport, Becker and Bergh, 1997). In terms of exclusive breastfeeding, at 3 months only 36% of infants were exclusively breastfed and this decreased to 7% at 6 months (Delport, Becker and Bergh, 1997). The study defined breastfeeding as exclusive when no additional food or milk was offered (Delport, Becker and Bergh, 1997). The large decrease in exclusive breastfeeding was due to the introduction of porridge, for

69% of the infant at 3 months of age and 99% of them at 6 months of age (Delport, Becker and Bergh, 1997). The breastfeeding initiation results in this study are consistent with the recent estimate of 88% for South Africa (UNICEF, 2009), however the prevalence for exclusive breastfeeding were low, again consistent with the prevalence for South Africa.

Sibeko and colleagues (2005) reported breastfeeding practices amongst mother in the peri-urban township of Langa, situated on the outskirts of Cape Town. Results indicated that 22% of the sample received predominant breastfeeding and 78% received complementary breastfeeding (Sibeko et al., 2005). Early introduction of complementary feeds was common, with 32 % of infants receiving complementary foods at approximately one year of age (Sibeko et al., 2005). Xhosa woman from this region of South Africa feeds colostrum or "mtubi" as a respected tradition, explaining the high rate of infants that ever received breastmilk (Sibeko et al., 2005). Some of the mothers in the study cited financial difficulties as a reason for introducing complementary feeds at an early age, while 43% of the mothers tended to rely more on breastmilk in this situation (Sibeko et al., 2005). The subjects also reported that they believed strongly in giving their infants water frequently; a practice that contributes to milk displacement, interferes with milk productions and may also leads to contamination of infant feeds (Sibeko et al., 2005). This study proposed cultural reasons for the early cessation and high prevalence of ever receiving breastmilk (Sibeko et al., 2005).

A cross-sectional study conducted in Limpopo, found that only 7.6% of mothers practiced exclusive breastfeeding and that 43.2% had introduced solid foods at three months and 15% before two months (Mushapi et al., 2008). A longitudinal study conducted in Limpopo found similar results with 44% of the infants exclusively breastfed in their first month of life. Furthermore, this decreased dramatically to 4.1% by 6 months old (Mamabolo et al., 2004). Early introduction of complementary feeds was noted, with 17.2 % receiving porridge in the first month of life. The prevalence of introduction of complementary foods at 3 and 6 months in these studies, are also consistent with results reported in the study by Delport, Becker and Bergh, (1997).

The studies above look at breastfeeding practices in South Africa from 1990 to 2016 and cover various areas within the country. It is evident that there is a high prevalence of initiation of breastfeeding, however exclusive breastfeeding rates are low and are accompanied by a high prevalence of early introduction of complementary feeds. This shows

that despite changes in South Africa's child nutrition policies, which are based on WHO recommendations; it is evident that the South African population is not adhering to WHO recommendation on infant breastfeeding and complementary feeding.

Infant feeding practices in South Africa are furthermore complicated by the HIV/AIDS (Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome) epidemic, a major public health concern and this has changed the way mothers have made decisions on how to feed their infant. In light of the policies on mother-to-child transmission, there was a shift away from breastfeeding and a move towards the use of breastmilk substitutes (formula) (Du Plessis et al., 2016). Initially in 2001, in the South African Prevention of Mother-To-Child Transmission (PMTCT) programme, women were advised to choose either exclusive breastfeeding with early weaning at 4–6 months or exclusive formula feeding with free infant formula provided until 6 months. In 2011, the WHO changed infant feeding guidelines for HIV/AIDS infected mothers, encouraging exclusive and continued breastfeeding in both HIV positive and negative mothers (Du Plessis et al., 2016).

As a result of continuous change to policy, particular harm to breastfeeding practices in South Africa may have been established from (1) health care provider confusion about infant feeding and HIV transmission through breastfeeding (2) lack of support for infant feeding counsellors (3) poor counselling skills (4) a disconnect between feeding recommendations and the socio-cultural context within feeding occurs (Du Plessis et al., 2016).

1.2.2 Stunting and wasting in children under 5 years of age in South Africa

Worldwide, young children between the age of 1-4 were found to be more stunting that older children aged 5-9 years old and no wasting was found in children 10 years or older (WHO, 2014). Worldwide the prevalence severity of wasting has been classified as low (WHO, 1995). Stunting and wasting are highly correlated with socio-economic status and environmental conditions (Zere and McIntyre, 2003) and this is consistent with associated food insecurity and household poverty (Labadarios et al., 2011). In line with the UNICEF causal framework of malnutrition, studies led in South Africa have reported higher prevalence of stunting in the more impoverished areas and communities (May and Govender, 1998). There were five times more Black African children that were stunted and underweight

in comparison to white children (Zere and McIntyre, 2003) and, in the Limpopo Province malnutrition rates were found to be high among people with low socioeconomic status, especially the rural black African children (Saloojee et al., 2007). These observed tendencies were attributed to the large range of inequality in incomes and the apartheid heritage of strong associations between ethnicity, socioeconomic status and health outcomes (Griffiths et al., 2008).

A systematic review by Monyeki and colleagues (2015) reviewed the available South African studies that reported the prevalence of undernutrition (stunting and wasting) and overweight in South African boys and girls between birth and twenty years of age, starting in the year 1990. Wasting was less prevalent than stunting (Monyeki et al., 2015) and a higher proportion of stunting was found in children living in rural areas compared to urban areas. The prevalence of stunting ranged between 6.0% (between 5-9 years) and 30.6% (between 1-9 years). Children staying in rural areas had a higher prevalence of stunting (20.6%) compared to children in urban areas (16.0%). Girls were also found to have a higher prevalence of stunting (18.9%) compared to boys (17.1%) (Monyeki et al, 2015). Similarly, the prevalence of wasting in children in rural areas (4.9%) was higher than that of children in informal urban (2.1%) and formal urban dwellings (2.6%).

The SANHANES-1 (2014) recorded the highest prevalence of stunting in children in the age group 0-3 years old. According to the SANHANES-1, the prevalence of wasting in children under 5 years of age was 5.1% in 2005, which then had a clear decrease to 2.2% in 2013 (Shisana et al., 2013). Nevertheless, Monyeki and colleagues (2015) mentioned difficulty in determining the change in prevalence in wasting in South Africa due to the different methods, sampling and growth references used in the existing nutritional surveys, which may have induced a disparity in results (Monyeki et al., 2015). A systematic review by Said-Mohamed and colleagues (2015), highlighted the most recent stunting prevalence data by Shisana et al., 2013 in the SANHANES-1 of 26.9% in boys and 25,9% in girls aged between 0-3 years of age, confirming that stunting amongst young children still persists as a public health burden. The above suggests that due to the available data it is difficult to establish whether wasting has decreased or increased in South Africa, however the prevalence of stunting in South Africa has stagnated and still remains as a public health burden.

1.2.3 Association between infant feeding practices and infant growth in South Africa

Optimum nutrition during the first two years of life is essential to health and growth (Das, Salam and Bhutta, 2016). A major element of infant feeding in the early years of life is the provision of breastmilk and appropriate complementary feeds (WHO, 2003). Undernutrition is strongly associated with early physical growth failure as well as shorter adult height and thinness (stunting and wasting) (Das, Salam and Bhutta, 2016).

A cross-sectional study conducted in Limpopo found that breastfeeding and weaning practices were not associated with infants' nutritional-status outcomes, namely weight-for-age, length-for-age and weight-for-length (Mushapi et al., 2008). A longitudinal study was conducted in the same province in infants from birth to age 12 months (Mamabolo et al., 2004). Data collected included infant feeding practices and anthropometry at 1, 3, 6, 9 and 12 months (Mamabolo et al., 2004). Of these infants, 48.9 % were underweight and 9.6% were stunted. However the growth pattern changed as the infants got older, with the infants gradually becoming stunted and overweight. Mamabolo and colleagues (2004) suggested that a decrease in the quantity of breast milk given and an early introduction of complementary feeds, such as maize meal and sorghum, provided the infants with "empty calories"; they were gaining weight due to the high carbohydrate content of the food, however lacking in nutrients and hence causing stunting (Mamabolo et al., 2004). Exclusive breastfeeding was found to be uncommon after 3 months of age, after which semi-solid and solid foods were introduced. There was a notable difference in the prevalence of breastfeeding between the studies. Mushapi and colleagues (2008) found a lower prevalence of exclusive breastfeeding and a higher prevalence of stunting while Mamabolo and colleagues (2004) found a higher prevalence of breastfeeding and lower prevalence of stunting. This may indicate possible protective effect of breastfeeding on stunting. However, there are discrepancies between the studies. The study by Mushaphi and colleagues (2008), did not report any association between breastfeeding and infant growth whereas the longitudinal study by Mamabolo and colleagues (2004) did report an association between breastfeeding and infant growth.

In children from the Birth-to-Twenty longitudinal cohort study (BT20) in Soweto (South Africa), Kagura and colleagues (2012) investigated the association between nutrition and growth during early infancy, and body composition at ten years of age. There was no association between the duration of predominant breastfeeding, bottle-feeding or age at

introduction of solids and wasting or underweight at age 2 years (Kagura et al., 2013). Using the same data, Slemming and colleagues (2017) examined the association between various household and maternal exposures in early life and stunting at two years old. They found that a shorter duration of breastfeeding was significantly associated with an increased risk of stunting at 2 years but only in an unadjusted analysis. Indeed, in multivariate analysis, household socio-economic status and maternal education, distal factors of undernutrition, had a stronger and significant association with the risk of stunting at age 2 years (Slemming et al., 2017). Using the same cohort, Gitau (2009) described complementary feeding practices at age one year and its association with infant growth at age 2 years. Ninety six percent of infants were introduced to solid foods when they were less than 6 months old, which included (listed in their ranking from most common to least common): mielie-meal (soft porridge or stiff mieliemeal), rice, meat and fish, cereals and grains, dairy and dairy products, vegetables, fruits, oils and fats and eggs. Nevertheless, Gitau (2009) did not find any association the dietary patterns at age one and growth at age two. In summary, previous studies using BT20 cohort data have looked at prevalence of wasting and stunting at 2 years and did not look at that prevalence at 1 year and how they change from 1 to 2 years. This does not allow the identification of the most sensitive period for growth faltering and undernutrition. In addition, only a few infant feeding practices were explored (exclusive breastfeeding, predominant breastfeeding, age at introduction of complementary feeds) and some were only used as categorical variable (duration of breastfeeding). Finally, it is also important to note that no studies have looked at the association between feeding practices, and stunting and wasting at 1 year and at 2 years. This gap does not allow the assessment of the short and relatively long term effects of feeding practices during the critical first two years of life.

Overall, the difference in results seen across the studies presented in this brief literature review could be due to *(1)* differences in feeding practices between the different populations investigated across studies, especially when population have different cultural background or education *(2)* longitudinal studies versus cross sectional studies *(3)* recall bias *(4)* data collection methods e.g. different questionnaires *(5)* differences between studies in terms of confounding factors affecting the relationship between infant feeding and growth *(6)* anthropometrical measurements accuracy and reliability across studies and sample sizes (7) age range of children examined in each of the studies. It is clear that more studies need to be conducted in order to overcome those limitations and to understand the complex relationship

between infant feeding practices and children's physical growth in the South African population and to identify what are the factors that influence infant feeding practices and physical growth in the first two years of life.

1.3 Problem Statement

In South Africa, the Department of Health initiated the Integrated Nutrition Programme in 1995. It aimed to ensure optimum nutrition for all South Africans by preventing and managing malnutrition (Faber and Wenhold, 2007). One of the major strategies it outlined was "Dietary Diversion/Modification" which included behaviour change to improve consumption through communications, social marketing and nutrition education (Faber and Wenhold, 2007). Recently, the Five years Roadmap for Nutrition for South Africa (2013-2017) aims at prioritising nutrition and nutrition related. (Department of Health, 2013). Its main objective is to promote child growth and nutrition and prevent overweight and obesity by focusing on the optimization of nutrition during the first thousand days of life, which has been identified as a critical period for nutritional intervention programs (Department of Health, 2013). Nevertheless, the recent surveys and systematic reviews (Said-Mohamed et al, 2015; Monyeki et al., 2015; Shisana et al., 2014) suggest that the prevalence of stunting and wasting has not changed dramatically despite 20 years of nutritional policies and intervention programs. The prevalence of stunting and wasting has remained high and the rate of exclusive breastfeeding has been very low, despite the policies implemented.

According to the above literature, there is an early cessation of breastfeeding, poor adherence to standards on the recommended duration of breastfeeding as well as an early introduction of complementary feeding in South Africa. The evidence of early introduction of complementary feeds across the different regions in South Africa may present a possible association with the prevalence of stunting and wasting. Nevertheless, there is a gap in South African literature regarding the association between infant feeding practices (breastfeeding, complementary feeding etc...) and growth in infancy (Du Plessis et al., 2016). Studies regarding singular associations between specific breastfeeding practices (breastfed ever, duration of breastfeeding, age at introduction of solids) and undernutrition (stunting and wasting) in the first two years of life are lacking in the South Africa context. In addition, historical data on infant feeding practices and its association with infant growth during the first two years of life are scarce while it is vital to understand the history of breastfeeding

practices and its association with undernutrition (stunting and wasting) in South Africa in order to understand and put the current prevalence in to perspective.

1.4 Justification

The recent systematic review by Said-Mohamed and colleagues (2015) demonstrated that stunting has been persistent in South Africa and that this trend of under nutrition has stayed relatively constant in South Africa since the early 1990s. This serves a question as to whether, in South Africa, infant feeding practices have been adhered to and the association between those practices and infant growth (Department of Health, 2010).

Furthermore, the first few years of life are vital as both physical and cognitive development take place. Any damage suffered in these stages may lead to permanent impairment and may also manifest itself in the development of the current generation in question's offspring. A review paper by Victora and colleagues (2008), discusses how child under nutrition (underweight, stunting and wasting) has long term consequences for adult health and human capital (height, school achievement, economic productivity, and birth weight of offspring of the current generation). According to their study (Victora, et al., 2008), height-for-age z-scores at 2 years old was the best predictor of human capital (productivity and the ability to earn an income); under nutrition was associated with lower human capital. Lower birth weight and stunting during childhood were associated with risk factors for high blood glucose levels, high blood pressure and high lipid profiles in adulthood (Victora, et al., 2008). Wasting was also linked to rapid post-natal weight gain suggested to be associated to inappropriate infant feeding practices such as early introduction of high calorie, carbohydrate rich complementary feeds. Accordingly, it is critical to assess the relationship between feeding practices, and more particularly breastfeeding practices, and growth during the first thousand days, in order to monitor growth and development. This will help prevent long term adverse effects on health and the recurring intergenerational cycle of poor nutrition and inadequate physical growth and development (Grantham-McGregor et al., 2007; Victora et al., 2008).

Thus, this study use data from the Birth-To-Twenty (BT20) prospective birth cohort study to investigate on the association between breastfeeding practices in the first year of life and infant growth at age 1 year and 2 years in the 1990s in South Africa. BT20 is a longitudinal study conducted in Soweto, Johannesburg and has followed up children at birth from 1990

until they turned 24 years of age. This is the largest and longest cohort study conducted in Africa (Richter et al., 2007). This study will look at data from the first two years of the BT20 cohort in 1990 to 1992. Unlike cross-sectional studies, the uncommon and distinctive longitudinal setting of the BT20 cohort study provide the advantage to best study the effect of infant breastfeeding practices on growth along the first two years of life. Furthermore, this study describes breastfeeding practices in an urban area in the early 1990s. As such, this study will provide information on infant breastfeeding practices and its association with growth in the first two years of life at the beginning of the Integrated Nutrition Program, against which current practices can be compared to, in a period where, in South Africa, there was a lack of emphasis and nutritional interventions program (Harrison, 1995). Finally, this study will contribute to our understanding of the complex relationship between nutrition during the first year of life and growth during infancy.

1.5 Aim of the Study:

To determine the relationship between infant breastfeeding practices and growth at 1 and 2 years of age in the BT20 cohort in 1990-1992.

1.6 Specific Objectives:

1. To describe breastfeeding practices, especially:
    a) To determine the prevalence of children that were ever breast-fed (infant who ever received breast-milk from their mothers) among children residing in Soweto- Johannesburg in 1990.
    b) To determine the duration of breastfeeding in children residing in Soweto-Johannesburg in 1990 by means of questionnaire.
    c) To determine the age at weaning on to semi-solid and solid foods in children residing in Soweto Johannesburg in 1990.
2. To determine the prevalence of stunting (height-for-age z-score<-2 of the median of the WHO growth standard) and wasting (weight-for-height z-score<-2 of the median of the WHO growth standard) at age 1 year old and 2 years old in children residing in Soweto- Johannesburg in 1990.
3. To assess the relationship between breastfeeding practices and height-for-age z-scores, stunting, weight-for-height z-scores, wasting all at age 1 year old and 2 years old in children residing in Soweto- Johannesburg in 1990.

2. Methodology

2.1 Study Design

The study was a secondary analysis study using data from the prospective BT20 cohort study. The BT20 cohort is a prospective study which began in 1990 to follow-up the growth of 3273 singleton children born to women residing in Soweto-Johannesburg in South Africa (Richter et al., 2007). The BT20 study is an ongoing multidisciplinary study which tracks the growth, health, well-being and educational progress of urban children across the first three decades of their life (Richter et al., 2007). BT20 used a lifecycle approach and covers many of the major issues challenging the particular developmental phase of children, adolescents and young adults on whom data has been collected - See Appendix A (Richter et al., 2007). The study began during the antenatal period, and information on pregnancy and birth. In 2000 a supplementary sample of total of 123 white children age 10 years of age (born in 1990) were collected during a bone health study, outside of Soweto, in the metropole, and were added to the cohort to compensate the absence of white participants in the original BT20 sample (Richter et al., 2007). The sample of white participants was not added for comparison purposes but rather to improve the BT20 cohort representativeness of the urban South African population in term of ethnicity. White participants underrepresentation was due to the fact that enrolment of pregnant women for the BT20 cohort study was made in Soweto's clinic in 1990. At that time, the population of Soweto was mainly composed of black African (Richter et al., 2007).

2.2 Study Site

The primary study took place in an urban area of Johannesburg (Gauteng Province, South Africa) known as South Western Township (Soweto). Soweto has a total surface area of 200.03 square kilometres with, in the 1990s, an estimated population of 1 271 628 including 98.9% of blacks, 0.0% of whites, 0.0% of Indians and 0.1% of Coloureds (Statistics South Africa, 1996).

2.3 Study Population

My secondary data analysis includes the study population of 3273 children born in 1990 that were followed up in the primary BT20 cohort study until their 24th month (2 years of age) follow-up (1990-1992) and the 123 children recruited in 2000 for which data on birth size,

gestational age, height at 1 and 2 years old, and weight at 1 and 2 years old were recorded from their Road-to-health card.

2.4 Sampling

The study was a secondary data analysis which included the data available for all the participants in the BT20 Cohort study between birth to 2 years old. There were three waves of data collection which took place between birth and 2 years: 6 months old, at 1 year old and at 2 years old. In 2000, supplementary data on 123 White Children was recorded from their Road-to-Health and was amalgamated in to the original sample of 3273 (Richter et al., 2007).

2.5 Measures and Variables:

The variables in this study can be summarised in an epidemiological overview. The diagram below (Figure 1) represents the variables in the categories of exposure, outcome and confounders and explains how they interact and influence each other.

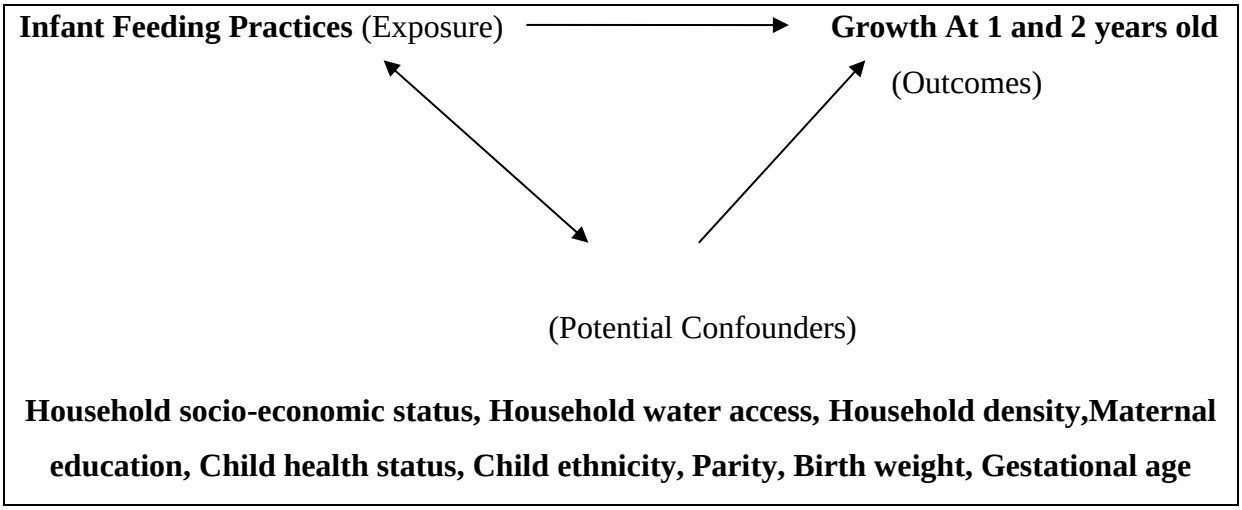


Figure 1: Interactions between Study Variables

2.6 Description of Variables and Method of Data Collection

Table 1: Description of Study Variables

Variable name	Description of Variable	Source(s)
Exposure Variables		
Ever breastfed	This variable was defined as whether the infant received breastmilk at least once. Yes/No (Categorical)	"Have you ever breastfed this baby?" 6 Month Core Questionnaire, pg 7, Question 1; Year 1 Core Questionnaire, pg7, Question 54; Year 2 Core Questionnaire, pg 8, Question 42
Duration of breastfeeding	This variable was defined as the length of time that the infant was breastfed for. Breastfeeding in this variable follows the WHO definition (2008). Months (Continuous)	"Are you still breastfeeding? How old was baby when you discontinued?" 6 Month Core Questionnaire, pg 7, Question 1a & I; Year 1 Core Questionnaire, pg 7, Question 55; Year 2 Core Questionnaire, pg 8, Question 42).
Age at introduction of complementary food	The variable was defined at the age at which the child had any other food than milk (semi- solid and solid foods, bottlefeeds that exclude breastmilk and formula)	"Has baby had food other than milk and what age you started?" 6 Month Core Questionnaire, pg 9, Question

Variable name	Description of Variable	Source(s)
	This variable is consistent with the definition of complementary feeding defined by the WHO (2008). Age in months (Continuous)	4a & b; 1 Year Core Questionnaire, pg 8, Question 62, Year 2 Core Questionnaire, pg 8, Question 46
Outcome Variables		
Child's growth at age 1 and 2 years old are the outcome variables.	The variables were defined as: • height-for-age z-score (HAZ) (WHO, 2006) • weight-for-height z-score (WHZ) (WHO, 2006) • Stunting (HAZ was equal to -2 standard deviations or less of the median of the reference population (WHO, 2006). • Wasting (WHZ was was equal to -2 standard deviations or less of the median of the reference population (WHO, 2006). HAZ (mean) (Contiuous) WHZ (mean) (Continous) Stunting (%) (Continuous) Wasting (%) (Continuos)	Anthropometric data on the infants were measured using standardized procedures at 1 and two years. Harpenden infantometer and stadiometer were used to measure children's length and height at 2 years respectively to the nearest 0.1 cm. Children's weight was measured to the nearest complete 0.1 kg using an infant digital scale.
Potential Confounders		
Child Health Status*	Presence or absence of diseases' symptoms and diseases were used as proxies of children health during their first and second year of life. Child Health Status (Categorical)	Data on child symptoms of disease were reported by the BT20 mothers or caregivers when the BT20 child was 6 months,1 year-old and 2 years-old.

Variable name	Description of Variable	Source(s)
		Data on child's disease were reported by the BT20 mothers or a caregivers when the BT20 child was 6 months and 2 years-old.
Ethncity	Participants were described as being either: white, black, coloured, Indian according to the South African census (Census, 2011). Ethnicity (Categorical)	Data on ethnicity was collected when the BT20 children were 6 months, 1 year and 2 years old (which allow to confirm and fill the information missing for participants that did not come for the 6 months or 1 year-old follow-up visit).
Parity	The number of previous children born alive Parity (Contiuous)	Data on parity was collected when the BT20 child was 6 months, 1 year and 2 years-old (which allow to confirm and fill the information missing for participants that did not come for the 6 months or 1 year-old follow-up visit)
Socio-economic Status (SES)	An aggregated index was created and reflects the household socio-economic status (Slemming et al, 2017). The index was constructed based on household's assets ownership, namely: electricity, television, radio, motor vehicle, washing machine, fridge, and telephone. The sum of assets owned in the household. The higher the SES score the better the socioeconomic status of the houshold the participant lives in.	The data on SES was collected via multiple questions asked when the BT20 child was 6 months, 1 year and 2 years-old (which allow to confirm and fill the information missing for participants that did not come for the 6 months-old or 1 year-old follow-up visit).

Variable name	Description of Variable	Source(s)
	SES (Continuos)	
Household Water	This variable was described by the type of water facility in the household and whether the household has access to either safe, indoor hot and cold water facilities (water from a tap) or inadequate outdoor water during the first two years of life. Household Water (Categorical)	The data on the type of household water facility was collected when the BT20 child was 6 months, 1 year and 2 years-old (which allow to confirm and fill the information missing for participants that did not come for the 6 months or 1 year-old follow-up visits).
Household Density	This variable represents the number of household inhabitants per room in the house. Household Density (Continuous)	Data on household density was collected antenatally.
Maternal Education	This vraiable described the highest school standard the mother passed according to 3 categories: no formal education to up to Grade 7, Grade 8-10, post-school training. Maternal Education (Categorical)	This information was collected through questionnaires when the BT20 child was 6 months, 1 year and 2 years-old (which allow to confirm and fill the information missing for participants that did not come for the 6 months or 1 year-old follow-up visit) by asking the highest school standard the mother passed.
Birth Weight	The infant's birth weight in kilograms (kg) Birth Weight (Continuos)	This data was collected from the BT20 participants' Road-to-Health Cards and clinical records when the BT20 child was 6 months and again at 1 year-old and 2 years-old which allow to confirm and fill the information missing for participants that did not come for the 6 months-old follow-up visit.

Variable name	Description of Variable	Source(s)
Gestational Age	The infant's gestational age in weeks. Gestational Age (Continuous)	This data was collected from the BT20 participants' Road-to-Health Cards and clinical records when the BT20 child was 6 months and 1 year (which allow to confirm and fill the information missing for participants that did not come for the 6 months-old follow-up visit).

- see further notes on description of Child Health Status

Child health status: The symptoms comprised: sneezing, runny nose, eye problem, cough or horseness, breathing problems, runny ears, diarrhoea, allergy. Data on child's disease were reported by the BT20 mothers or a caregivers when the BT20 child was 6 months and 2 years-old. Reported diseases comprised: pneumonia, bronchiolitis, asthma, croup and measles. To increase the sample size as many infants were not seen at 6 months, aggregated indices, namely symptom score and disease score, were calculated. For instance, for each participant, the symptom score between birth and 1 year of age is equal to the ratio between the sum of symptoms reported and the number of data collection points attended between birth and 1 year old. Similar calculations were done to obtain for each participant the symptom score between birth and 2 years of age, the disease score between birth and 1 year and the disease score between birth and two years. The reason for using a ratio is that some participants came at all their data collection points and thus have had their symptoms reported more frequently in comparison to those who missed some data collection points. As a consequence, if the score was constructed as the sum of symptoms reported, the latter would always have a lower score; hence the use of the ratio to the number of data collection points. The higher the score the higher the frequency of occurrence of disease's symptom or disease.

2.7 Data Processing Methods and Data Management Plan

Data Extraction and Cleaning

Data cleaning and management whereby one checks the data for accuracy, consistency and completeness was previously completed for previous BT20 published studies (Adair et al., 2013, Victora et al., 2008; Fall et al., 2011). The process of data cleaning and management included checking for duplicates, missing values, extreme values, deleting or imputing values, recoding and categorising variables. I used frequency tables were used to assist with data management and cleaning.

2.8 Data Analysis

2.8.1 Analytic sample

To ensure whether the participants included in the analysis (participants with infant complete feeding practice and growth data) were an accurate representation of full BT20 cohort, participants in the analytic sample were compared to participants with missing data (without data on infant feeding practices or growth) according to their demographic and birth characteristics.

2.8.2 Data analysis

Table 2: Data Analysis

Data Analysis	
Objective 1	Description of breastfeeding practices a. *Ever breastfed* variable (categorical variable): Description was done using frequencies and percentages b. *Duration of breastfeeding* variable (continuous variable): Description was done using the mean, and standard deviation c. Age at introduction of solid and semi solid foods (continuous variable): Description was done by using the mean and standard deviation

Data Analysis	
Objective 2	To determine the prevalence of stunting (height-for-age z-score<-2 of the median of the WHO growth standard) and wasting (weight-for-height z-score<-2 of the median of the WHO growth standard) at age 1 year old and 2 years old in children residing in Soweto- Johannesburg in 1990. a. Height-for-age z score (continuous variable): Description was done by using the mean and standard deviation b. Stunting: the prevalence of stunting was calculated as the proportion of children with HAZ≤-2, with 95% confidence interval. c. Weight-for-height z scores (continuous variable): Description was done by using the mean, and standard deviation d. Wasting: the prevalence of wasting was calculated as the proportion of children with WHZ≤-2, with 95% confidence interval.
Objective 3	To assess the relationship between breastfeeding practices and height-for-age z-scores, stunting, weight-for-height z-scores, wasting all at age 1 year old and 2 years old in children residing in Soweto- Johannesburg in 1990. **1. Bivariate analysis of Exposure and Outcome** <u>Exposure 1: Breastfed Ever</u> a. Compared the difference height-for-age z score between infants who were ever breastfed and infants who were never breastfed by a t-test b. Relationship between breastfeeding practice and stunting was done by chi-square test c. Compare weight-for-height z score in infants who were ever breastfed and infants who were never breastfed by a t-test d. Relationship between breastfeeding practice and wasting was done by chi-square test <u>Exposure 2: duration of breastfeeding</u> a. Relationship between duration of breastfeeding and height-for-age z score was done by spearman correlation test b. Compared the duration of breastfeeding between stunted and non-

Data Analysis	
	stunted infants by a t-test c. Relationship between duration of breastfeeding and weight-for-height z-score was done by spearman correlation test d. Compared the duration of breastfeeding between wasted and non-wasted infant by a t-test <u>Exposure 3: Age at Introduction of Solids</u> a. Relationship between age at weaning and height-for-age z-score was done by spearman correlation test b. Compare the age at introduction of solids between stunted and non-stunted infants by a t-test c. Relationship between age at introduction of solids and weight-for-height z-score was done by spearman correlation test d. Compare the age at introduction of solids between wasted and non-wasted infants by t-test **2. Univariate Analysis** The association between HAZ, WHZ, Stunting and Wasting at 1 and 2 years and covariates were tested using simple linear or logistic regression analysis where appropriate. This identified which covariates were statistically significantly associated with the growth variables. **3. Multivariate analysis between Exposures and Outcome adjusted for confounder variables.** The association between HAZ or WHZ and different exposures adjusted for confounders were assessed using respectively 2 multilinear regression models. The association between stunting or wasting and the different exposures adjusted for confounders were done using 2 logistic regression analyses. **4. Comparison of the analytic sample and the participants with missing data**

Data Analysis	
	Participants in the analytic sample (with complete data on infant feeding practices and growth) were compared to participants with missing data (without data on infant feeding practices or growth) according to their demographic and birth characteristics in order to assess bias introduced by missing data and representativeness of this study.

All continuous variables were tested for normality of distribution. All of the study variables were normally distributed and therefore mean and standard deviations were presented in the descriptive data.

- Before performing t-tests analysis, equality of variance was tested for.

- The cut-off for the level of significance of the statistical analysis was ($p<0.05$).

2.9 Ethical Considerations

For the BT20 prospective cohort study, ethics approval was previously obtained from the University of the Witwatersrand Committee for Research on Human Subjects (Clearance certificate number: M01-05-56). In the case of my research and the proposed secondary analysis of the BT20 cohort study dataset, I applied for and received ethics approval from the Human Research Ethics Committee of the University of the Witwatersrand (Ethics Approval Number: M160376). To protect the confidentially of participants in the study, the dataset was sent in an anonymous format, making it impossible to identify any participant.

3. Results

The general descriptive analysis of all the study variables, growth at one and two years (stunting and wasting, weight-for-height and height-for-age z-scores), infant feeding practices (ever breastfed, duration of breastfeeding and age at introduction of solid and semi solid foods) and covariates (maternal education, ethnicity, parity, birth weight, gestational age, parity, household socio-economic status, household water, household density) are described in this section. In this chapter are then presented the results of the univariate analyses assessing the associations between infant feeding practices and growth at one and two years old, and the possible associations between growth with the potential confounders. Finally, in this section, results from the multivariate analysis assessing the association between infant feeding practices and growth at one and two years independently of potential confounders are presented.

3.1 Sample Selectivity

Table 3 presents the comparison of the analytical sample (with data on infant feeding practices and growth) and the sample of participants with missing data (without data on infant feeding practices and/or growth). A comparison of demographic characteristics, birth weight, gestational age, household density, access to water facilities, parity and socioeconomic status was made between those with data on infant feeding practices and growth (n=3229) and those without (n=170). A comparison was done between the analytical sample and the participants with missing data in order to evaluate sample representativeness. A significant difference between the two samples was noted for the following variables; ethnicity, gestational age and access to water. This is indicative of selection bias i.e. the sample size was not a 100% a representative of the cohort. The Birth-to-Twenty cohort is meant to be representative of the entire South African population (Richter at al., 2007) however the sample of missing data or analytical sample is made up of mainly white participants that were recruited in 2000 and for which the data for the infancy period could not be obtained using the Road-to-Health cards.

Table 3: Comparison of the analytic sample and the sample of participants with missing data

	Analytic sample		Participants missing data		p-values
	Means (SD) or percentage	**N**	**Means (SD) or percentage**	**N**	
Gender					ns
Male	48.8%	1576	45.9%	78	
Female	51.2%	1653	54.1%	92	
Maternal Education					<0.001
No formal education to up to Grade 7	15.5%	451	3.8%	5	
Grade 8-10	73.3%	2131	43.2%	57	
Post School Training	11.2%	325	53%	70	
Ethnicity					<0.001
White	6.4%	207	70%	119	
Black	78.6%	2539	20.6%	35	
Coloured	11.6%	373	6.5%	11	
Indian	3.4%	110	2.9%	5	
Birth weight	3.1 (0.5)	3223	3.1 (0.6)	141	ns
Gestational Age	38.1 (1.9)	3128	38.6 (2.4)	68	0.03
Household Density	3.3 (1.6)	2625	3.6 (3.0)	24	ns
Water					0.01
Poor access to water facilities (outdoor water)	69.08%	1667	45.83%	11	
Good access to water facilities (indoor hot and cold running water)	30.92%	746	54.17%	13	
Parity	2.24 (1.38)	3229	1.98 (1.16)	151	ns
SES	3.61 (1.87)	2401	3.17 (2.15)	23	ns

Significance levels: p <0.05, ns: not significant, SES: socioeconomic status

3.2 Description of study participants and covariates.

A total of 3229 participants were included in the analytical sample. Of the total number of participants in the analytical sample, 48.7% were male and 51.3% were female. Participants mean birthweight was 3.07 kg and the median of participants' gestational age was 38 weeks.

In terms of caregiver characteristics, the majority of mothers (72%) reported that they had completed school up to Grade 8, 9 or 10. It was reported that 15% of mothers had a formal education less than Grade 7 or none, and 13% of mothers reported post-school training (See Table 4).

Table 4: Description of participants sociodemographic characteristics and covariates

		Mean (SD), Percentage or Median (Ranges)	**N**
BT20participants characteristics			
Ethnicity (%)	White Black Coloured Indian	9.6% 75.7% 11.3% 3.4%	326 2574 384 115
Birthweight (kg)	Mean (SD)	3.1 (0 .51)	3364
Gestational Age (weeks)	Mean (SD)	38.2 (1.92)	3196
Gender (%)	Male Female	48.7% 51.3%	1654 1745
Caregiver characteristics			
Parity (number of pregnancies)	Mean (SD)	2.23 (1.37)	3380
Maternal Education (%)	No formal education to up to Grade 7 Grade8-10 Post-School Training	15% 72% 13%	456 2188 395
Socioeconomic Status score	Mean (SD)	5.2 (2.5)	2054
Household Density	Mean (SD)	3.3 (1.6)	2649
Water (%)	Good water facilities Poor water facilities	68.9% 31.1%	1678 759
Symptoms (Birth-1 Year)			
Symptoms Score	Mean (SD)	0.3 (0.3)	2733
Symptoms (Birth-2 Years)			
Symptoms Score	Mean (SD)	0.4 (0.3)	2913
Diseases (Birth-1 Year)			
Aggregated Index	Mean (SD)	1.9 (0.1)	1865
Diseases (Birth-2 Years)			
Aggregated Index	Mean (SD)	0.0 (0.1)	2599

Participants included in the analytical sample were compared to participants with missing data according to their demographic data and birth characteristics (See Table 3). These two samples differ in their ethnic composition ($p<0.001$) i.e. there were more white and less black, coloured and Indian participants in the sample with missing data compared to the analytical sample. The main reason for this discrepancy is that in 2000, 123 white children were recruited in to the study at the age of 10 years old and their birth to two years old data could only be found in their Road to Health records which was not always available (Richter et al., 2007).The analytical sample also differed in their access to water facilities ($p<0.01$); there were more participants in the sample with missing data that did have access to good water facilities. The analytical sample also differed in level of maternal education ($p<0.001$), there were more participants in the sample with missing data that had post school training. Gestational age also differed ($p<0.03$) between the two samples; the mean gestational age (38.6 weeks) was higher in the group with the missing data. There were no statistically significant differences between the analytical sample and the sample of participants with missing data in their gender, birth weight, household density, parity and socioeconomic status as $p>0.05$ for those variables.

3.3 Description of infant feeding variables (Objective 1)

A proportion of 93.7% (3001) participants were breastfed at least once (ever) and the median duration of breastfeeding in the analytical sample was 10 months. The mean age for introduction of solid and semi solid foods was 3.6 months (See Table 5).

Table 5: Participants' feeding practices

		Mean (SD), Percentage or Median (Ranges)	**N**
Participant's Feeding Characteristics			
Ever Breastfed (%)	Yes	93.7%	3001
Duration of Breastfeeding (months)	Mean (SD)	11.6 (8.3)	2313
Age when introduced to solids (months)	Mean (SD)	3.6 (1.7)	2893

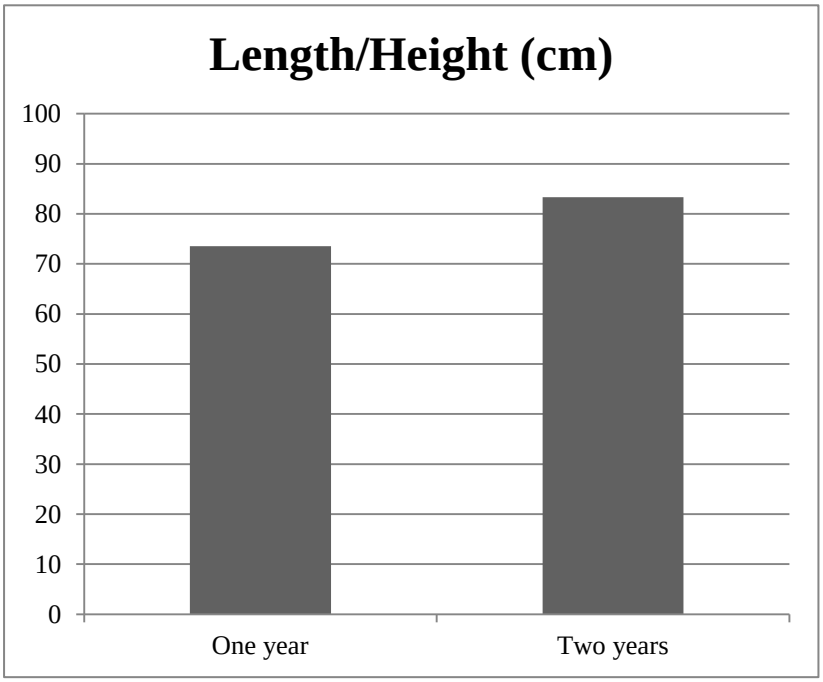
3.4 Description of growth variables (Objective 2)

At one year old, participants' mean weight was 9.23 kg. Participants' mean height was 73.5cm. The prevalence of stunting and wasting amongst participants was 8.4% and 2.2% respectively. At year two participants' mean weight was 11.38 kg and their mean height was 83.3cm (See Table 6). Accordingly, the average growth in height from one year to two years of age was 9.81 cm (See Figure 2).

Table 6: Participants' growth characteristics

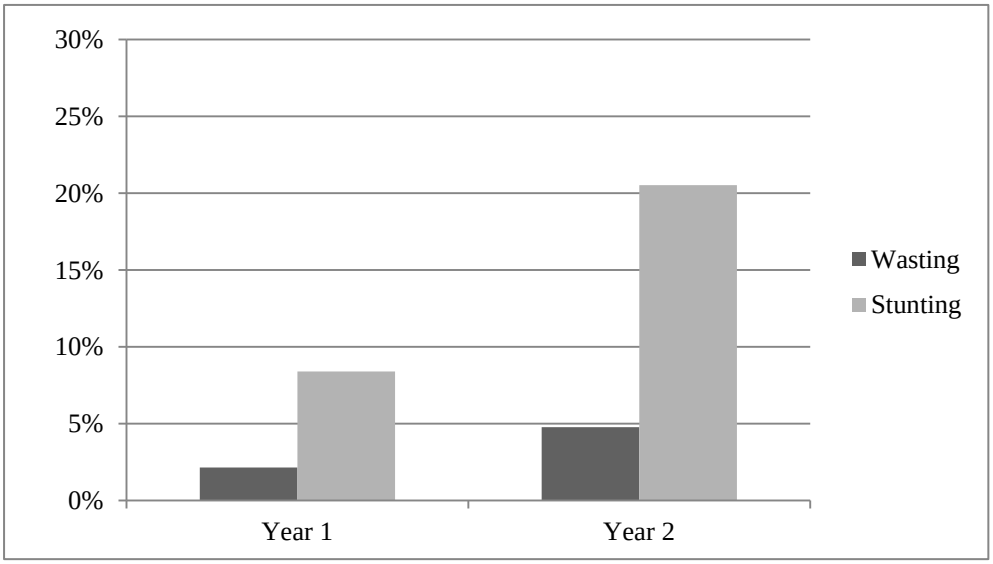
		Mean (SD), Percentage or Median (Ranges)	**N**
BT20 participants anthropometric characteristics at 1 year old			
Weight-for-length z-score	Mean (SD)	0.25 (1.19)	1998
Length-for-age z-score	Mean (SD)	-0.5 (1.2)	1999
Height (cm)	Mean (SD)	73.5 (3.0)	1999
Weight (kg)	Mean (SD)	9.2 (1.2)	2356
Stunting (%)	Percent	8.4%	168
Wasting (%)	Percent	2.2%	43
BT20 participants anthropometric characteristics at 2 years-old			
Weight-for-length z-score	Mean (SD)	0.19 (1.35)	1804
Length-for-age z-score	Mean (SD)	-1.16 (1.12)	1805
Height (cm)	Mean (SD)	83.35 (3.57)	1805
Weight (kg)	Mean (SD)	11.38 (1.41)	2191
Stunting (%)	Percent	20.5%	370
Wasting (%)	Percent	4.8%	86

Figure 2: Mean Height (cm) at one year and two years of age



At two years of age the prevalence of stunting was 20.5% and wasting was 4.8% (See Figure 3).

Figure 3: Prevalence of stunting and wasting at one year and two years of age



3.5 Description of covariates

Child health status and diseases were reported by means of aggregated indices described in the methods section, with further descriptions of individual items (See Table 4).

The prevalence of symptoms was higher in birth-2 years than birth-1 year (See Figure 4). Cough/hoarseness was the most common symptoms followed by runny nose, sneezing, diarrhoea and breathing problems.

The prevalence of disease amongst participants was higher in birth-2 years than birth-1 year (See Figure 5). The most commonly reported disease was bronchiolitis, followed by pneumonia and croup.

Figure (4): Prevalence of reported child health symptoms at between birth-1 year old and between birth-2 years

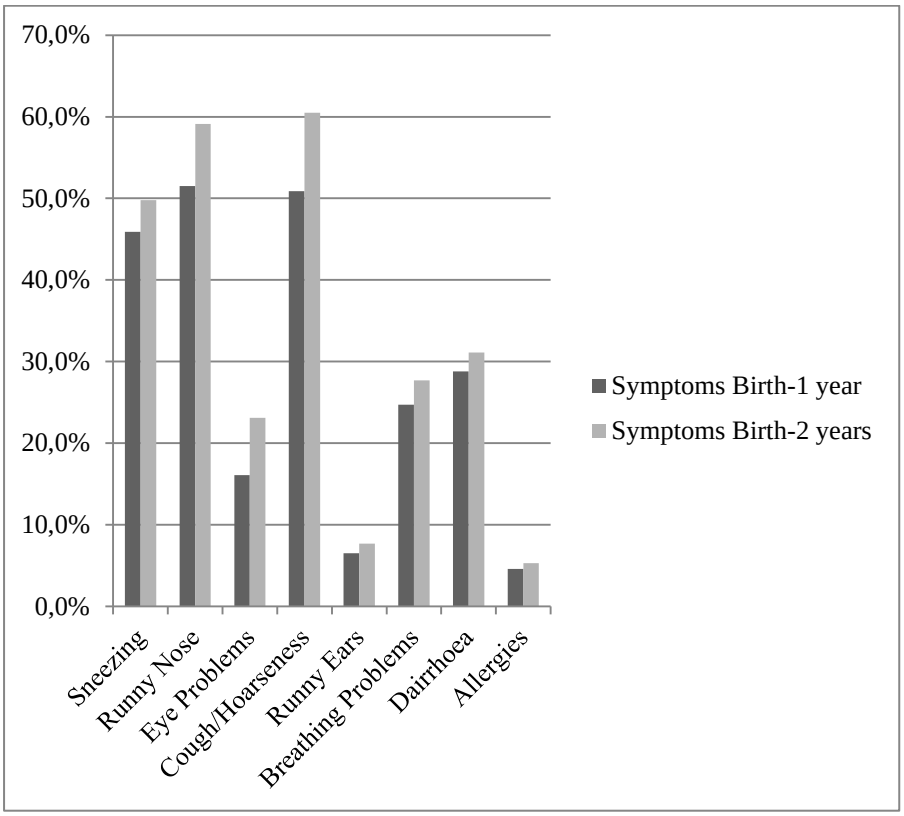
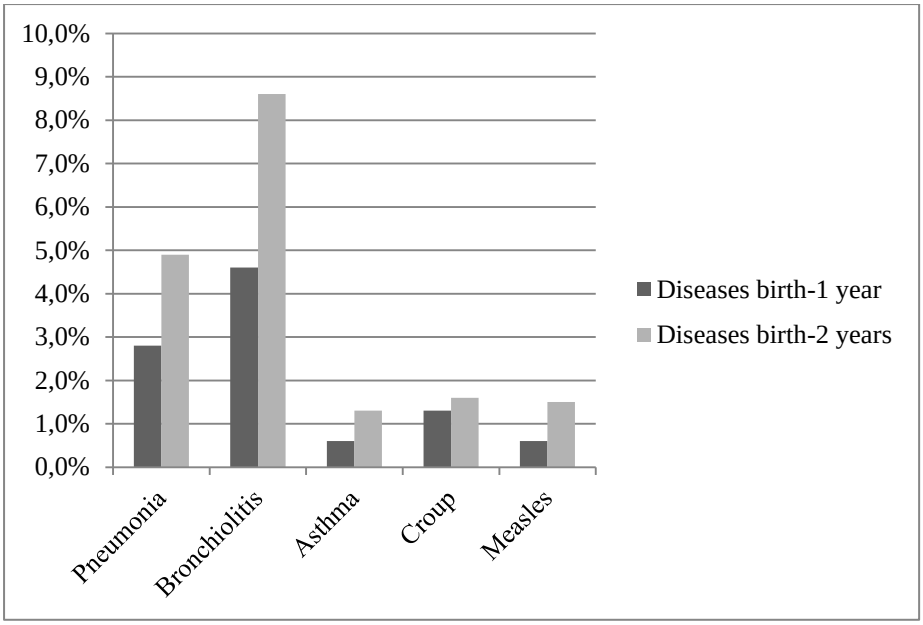


Figure (5): Prevalence of reported infant diseases between birth-1 year old and between birth-2 years old



3.6 Association between breastfeeding practices and growth using bivariate analysis (Objective 3)

In the bivariate analysis, we assessed the unadjusted association between infant feeding practices (ever breastfed, duration of breastfeeding and age at introduction of solids) and growth at 1 and two years (as shown in Table 7 and 8).

Table 7 presents the results of the bivariate statistical analysis between breastfeeding practices and length/height-for-age z-score and stunting at 1 and 2 years of age. At one year, LAZ (Length-for-Age Z-score) was negatively but weakly correlated with the duration of breastfeeding: an increase in the duration of breastfeeding was correlated with a decrease in HAZ (rho=-0.11, $p<0.001$). At two years, HAZ was also negatively but weakly correlated with the duration of breastfeeding (rho=-0.13 $p<0.001$). A statistically significant association between duration of breastfeeding and stunting was noted at two years: stunted children were breastfed longer than not stunted children (13.8 vs. 12.3 months, $p=0.004$). There were no statistical significant associations noted between being ever breastfed and age at introduction of solids with HAZ or stunting at one or two years.

Table 8 presents the results of the bivariate analysis between breastfeeding practices and weight-for-height z-score and wasting at 1 and 2 years of age. At 2 years, there was a marginally statistical significant and weak positive correlation recorded between duration of breastfeeding and WHZ (rho = 0.05 p= 0.057). At 2 years, a marginal statistical significant

but weak negative correlation was also noted between age at introduction of solid and semi solid foods and WHZ (rho = -0.05 p= 0.054). There were no associations noted between being ever breastfed with WHZ and wasting at 1 year and 2 years. No associations were noted between duration of breastfeeding and wasting at 1 year as well as age at introduction of solids and wasting at 1 year and 2 years.

Table 7: Bivariate associations between breastfeeding practices and height/length-for-age z-score and stunting at 1 and 2 years

		1 year					2 years				
		HeightLength-for age z-score (n=1999) Mean (SD) or Rho	P	**Stunted (n=168)** % or mean(SD)	**Not stunted (n=1831)** % or mean(SD)	p	**Height-for age z-score (n=1805)** Mean (SD) or Rho	P	**Stunted (n=370)** % or mean(SD)	**Not stunted (n=1433)** % or mean(SD)	p
Ever breastfed	Yes	-0.53 (1.15)	ns	92.2%	94.6%	ns	-1.17 (1.13)	ns	95.4%	94.2%	ns
	No	-0.54 (1.46)		7.8%	5.4%		-1.07 (1.08)		4.6%	5.8%	
Duration of breastfeeding	months	-0.11	***	12.9 (8.6)	11.9 (8.9)	ns	-0.13	***	13.8 (8.5)	12.3 (8.9)	***
Age at introduction of solids	months	0.02	ns	3.5 (1.3)	3.6 (1.67)	ns	0.04	ns	3.6 (1.9)	3.6 (1.6)	ns

Level of significance: * p < 0.05, ** p<0.01, *** p <0.001, ns: not significant

Table 8: Bivariate associations between breastfeeding practices and weight-for-height z-score and wasting at 1 and 2 years

		1 year					2 years				
		Weight for height z-score (n=1998) Mean (SD) or Rho	p	**Wasted (n=43)** % or mean(SD)	**Not wasted (n=1955)** % or mean(SD)	P	**Weight for height z-score (n=1804)** Mean (SD) or Rho	P	**Wasted (n=86)** % or mean(SD)	**Not wasted (n=1718)** % or mean(SD)	p
Ever breastfed	Yes	0.27 (1.19)	ns	88.4%	94.6%	ns	0.19 (1.36)	ns	94.2%	94.5%	ns
	No	0.13 (1.22)		11.6%	5.4%		0.20 (1.22)		5.8%	5.5%	
Duration of breastfeeding	Months	-0.02	ns	11.1 (7.5)	12.1 (8.9)	ns	0.05	ns(0.05)	12.9 (8.74)	12.6 (8.82)	ns
Age at introduction of solids	Months	-0.04	ns	3.4 (3.1)	3.6 (1.6)	ns	-0.05	ns(0.05)	3.9 (2.27)	3.6 (3.48)	ns

Level of significance: * p < 0.05, ** p<0.01, ***, p <0.001, ns: not significant

3.7 Association between covariates and growth (univariate analysis)

In this section results are presented on the association between growth indices with covariates that could potentially affect growth (See Table 9).

In looking at the association between covariates and length-for-age at age one year, length-for-age z-score was negatively associated with household density, as well as being black, coloured or Indian ancestry as compared to being white. Length-for-age z-score was positively and significantly associated with socioeconomic status and birth weight. Having a mother of grade 8-10 or with post-school training is associated with an increase in length-for-age at age 1 year by 0.26 and 0.45 respectively as compared to having a mother with less education than grade 7. Having a good access to water facilities is associated with an increase by 0.35 in length for age z-score at 1 year of age as compared to having a poor access to water facilities (See Table 9).

With regards to the association between covariates and height-for-age at age two years old, infants in the study were likely to have an increase in height-for-age z-score at two years if born to a mother with a higher level of education (grade 8-10 or post-school training). Height-for-age z-score was also positively associated with disease score between birth and 2 years, birth weight, socioeconomic status and access to good water facilities. Height-for-age z-score was negatively associated with parity and household density. They were also likely to have a decrease in height-for-age z-score at two years if they were of black, coloured or Indian ancestry as compared to being born of white ancestry (See Table 9).

With regards to the association between covariates and weight-for-height at age one year old, weight-for-height z-score at age one was negatively associated with being born to a mother of Indian ancestry compared to being born to a white mother and positively associated with being from a black mother. A decrease in weight-for-height z-score was associated with a good access to quality water facilities. Their weight-for-height z-score was positively associated with birth weight (See Table 9).

In respect of the association between covariates and weight-for-height at two years old, children in the study were likely to have a decreased weight-for-height at age two if of coloured or Indian ancestry as compared to being born to an origin of white ancestry (See Table 7). A decrease in weight-for-height z-score was also associated with poor access to water facilities. Weight-for-height z-score was positively associated with symptoms score

between birth and 2 years. Weight-for-height z-score was positively associated with birth weight.

In looking at the association between covariates and stunting at one year old, the odds of being stunted increased by 13% with an increase in household density. The odds of being stunted decreased by 49% and 61 % if their mother had an education of Grade 8-10 or post school training respectively in comparison to having a mother with no formal to grade 7 education level. The odds of being stunted at one year of age decreased by 15% with an increase by 1 unit in the socioeconomic status score. The odds of being stunted decreased by 78% with an increase by 1kg in birth weight. The odds of being stunted decreased by 52% with better access to water facilities (See Table 9).

In respect of the association between covariates and stunting at two years old, the odds of being stunted was 2.5 times more likely if participants were of black ancestry as compared to being of white origin and the odds of being stunted were 2.2 times more likely if participants were of coloured origin as compared to being of white origin. The odds of being stunted also increased by 9% with an increase in parity and by 15% with an increase by one unit in household density. The odds of being stunted at two years decreased 31% and 58% with a maternal education of Grade 8-10 and post school training respectively in comparison to being born to a mother with no formal to grade 7 education level. The odds of being stunted decreased by 15% with an increase by one unit in the socioeconomic status score. The odds of being stunted decreased by 61% with an increase by 1kg in birth weight and by 40% with better access to quality water facilities (See Table 9).

When looking at the association between covariates and wasting at one year old**,** the odds of being wasted at one year were 3.7 times more likely with an increase by one unit in the symptoms score between birth and one year (See Table 9).

In regards to the association between covariates and wasting at age two years old, the odds of being wasted a two years were 10.2 times more likely if you were of coloured ancestry as compared to being of white ancestry (See Table 9).

Table 9: Association between covariate and growth (Univariate Analysis)

Growth Variables	Length-for-age year 1			Height-for-age year 2			Weight-for-height year 1			Weight-for-height year 2		
	B	**95% CI Interval**	**P**	**β**	**95% CI Interval**	**p**	**β**	**95% CI Interval**	**p value**	**β**	**95% CI Interval**	**p**
Ethnicity												
White	Ref			Ref			Ref			Ref		
Black	-0.86	(-1.09 - -0.62)	<0.001	-0.87	(-1.11 - -0.63)	<0.001	0.30	(0.06 - 0.54)	0.02	-0.01	(-0.29 - 0.27)	ns
Coloured	-0.72	(-0.98 - -0.45)	<0.001	-0.76	(-1.02 - -0.49)	<0.001	-0.23	(-0.50 - 0.03)	ns	-0.87	(-1.19 - -0.56)	<0.001
Indian	-0.61	(-0.97 - -0.24)	0.001	-0.40	(-0.77 - -0.04)	0.03	-0.70	(-1.07 - -0.34)	<0.001	-0.94	(-1.37 - -0.51)	<0.001
Maternal Education												
No formal education to up to Grade 7	Ref			Ref			Ref			Ref		
Grade 8-10	0.26	(0.11 - 0.42)	0.001	0.25	(0.09 - 0.41)	0.002	0.17	(0.01 - 0.33)	ns	-0.10	(-0.30 - 0.09)	ns
Post School Training	0.45	(0.24 - 0.66)	<0.001	0.63	(0.41 - 0.84)	<0.001	0.06	(-0.15 - 0.28)	ns	-0.17	(-0.42 - 0.09)	ns
Symptom Score (birth- 1 year)	-0.09	(-0.29 - 0.12)	ns	-0.03	(-0.24 - 0.17)	ns	-0.02	(-0.23 - 0.18)	ns	-0.09	(-0.34 - 0.16)	ns
Symptom Score (birth- 2 years)	n/a			-0.09	(-0.31 - 0.13)	ns	n/a			0.13	(-0.14 - 0.39)	0.02
Disease Score (birth- 1 year)	-0.18	(-0.75 - 0.39)	ns	-0.18	(-0.75 - 0.39)	ns	-0.10	(-0.69 - 0.48)	ns	0.98	(-0.58 - 0.78)	ns
Disease Score (birth- 2years)	n/a			0.48	(-0.01 - 0.97)	0.05	n/a			0.37	(-0.22 - 0.96)	ns
Parity	-0.03	(-0.07 - 0.01)	ns	-0.06	(-0.09 - -0.02)	0.002	-0.03	(-0.07 - 0.01)	ns	-0.02	(-0.06 - 0.3)	ns
Socioeconomic Status	0.11	(0.08 - 0.14)	<0.001	0.12	(0.09 - 0.15)	<0.001	-0.02	(-0.05 - 0. 01)	ns	-0.03	(-0.07 - 0.01)	ns
Birth Weight	0.82	(0.72 - 0.91)	<0.001	0.59	(0.50 - 0.69	<0.001	0.52	(0.42 - 0.62)	<0.001	0.46	(0.34 - 0.58)	<0.001
Household Density	-0.08	(-0.11 - -0.05)	<0.001	-0.11	(-0.13 - -0.72)	<0.001	0.00	(-0.03 - 0.03)	ns	0.01	(-0.03 - 0.05)	ns
Water												
Poor access to water	Ref			Ref			ref			ref		
Good access to water	0.35	(0.23 - 0.47)	<0.001	0.33	(0.20 - 0.45)	<0.001	-0.22	(-0.35 - -0.10)	0.001	-0.20	(-0.35 - -0.06)	0.01

Significance level: $p < 0.05$, ns- not significant, ref: reference, n/a- non applicable

Growth variables	Stunting year 1			Stunting year 2			Wasting year 1			Wasting year 2		
	odds ratio	**95% CI**	**p**	**odds ratio**	**95% CI**	**P**	**odds ratio**	**95% CI**	**P**	**odds ratio**	**95% CI**	**p**
Ethnicity												
White	Ref			Ref			Ref			Ref		
Black	3.11	(0.97 - 9.95)	ns	2.48	(1.23 - 5.00)	0.01	0.53	(0.16 - 1.79)	ns	3.36	(0.46 - 24.61)	ns
Coloured	2.38	(0.70 - 8.17)	ns	2.19	(1.04 - 4.63)	0.04	0.97	(0.27 - 3.65)	ns	10.23	(1.37 - 76.17)	0.02
Indian	2.57	(0.59 - 11.14)	ns	P.30	(0.06 - 1.45)	ns	2.54	(0.59 - 11.02)	ns	6.21	(0.68 - 57.04)	ns
Maternal Education												
No formal education up to Grade 7	Ref			Ref			Ref			Ref		
Grade 8-10	0.51	(0.34 - 0.77)	<0.001	0.69	(0.50 - 0.95)	0.02	0.95	(0.36 - 2.48)	ns	1.19	(0.61 - 2.36)	ns
Post School Training	0.39	(0.20 - 0.74)	<0.001	0.42	(0.26 - 0.69)	0.001	2.19	(0.74 - 6.51)	ns	0.75	(0.28 - 2.02)	ns
Symptoms (birth-1 year)	2.11	(1.16 - 3.82)	0.01	1.24	(0.79 - 1.95)	ns	3.67	(1.21 - 11. 09)	0.02	1.18	(0.49 - 2.87)	ns
Symptoms (birth-2years)	n/a			1.00	(0.62 - 1.61)	ns	n/a			0.52	(0.21 - 1.29)	ns
Diseases (birth- 1 year)	0.47	(0.12 - 1.88)	ns	1.23	(0.34 - 4.53)	ns	18.36	(0.04 - 8821.87)	ns	1.49	(0.09 - 25.51)	ns
Diseases (birth- 2 years)	n/a			0.50	(0.16 - 1.52)	ns	n/a			0.64	(0.08 - 5.21)	ns
Parity	1.11	(1.00 - 1.23)	ns	1.09	(1.00 - 1.17)	0.04	1.18	(0.97 - 1.42)	ns	0.94	(0.79 - 1.10)	ns
Socioeconomic Status	0.85	(0.77 - 0.94)	0.001	0.85	(0.80 - 0.91)	<0.001	0.16	(0.96 - 1.40)	ns	0.94	(0.83 - 1.06)	ns
Birth Weight	0.22	(0.17 - 0.30)	<0.001	0.39	(0.31 - 0.49)	<0.001	0.59	(0.34 - 1.03)	ns	0.73	(0.48 - 1.11)	ns
Household Density	1.13	(1.04 - 1.24)	0.003	1.15	(1.07 - 1.23)	<0.001	1.03	(0.85 - 1.25)	ns	1.07	(0.95 - 1.21)	ns
Water												
Poor Access to Water	Ref			Ref			Ref			Ref		
Good Access to Water	0.48	(0.31 - 0.75)	0.001	.60	(0.45 - 0. 81)	0.001	1.75	(0.93 - 3.29)	ns	1.18	(0.71 - 1.98)	ns

Significance level: $p < 0.05$, ns- not significant, ref: reference, n/a – non applicable

3.8 Association between breastfeeding practices and growth at one and two years of age (multivariate analysis)

In the univariate analysis, the association between infant feeding practices (ever breastfed, duration of breastfeeding and age at weaning) and infant growth (stunting, wasting, length/height-for-age and weight-for-height at age one and two) and gender, maternal education, ethnicity birth weight, symptom scores, disease scores, parity, socio-economic status, access to toilet and water were assessed individually. It is well known that the above factors may be related to infant feeding and growth and they are known to be correlated (Fall et al., 2011; Slemming et al., 2017). It is therefore of interest to test whether the association between breastfeeding practices and growth found in bivariate analyses remains after adjusting for the covariates associated with growth. Therefore multiple regression analyses were conducted in order to investigate the effect of: gender, maternal education, ethnicity birth weight, symptom score, disease score, parity, socio-economic status, access to water facilities on the association between infant feeding practices and growth at one and two years.

3.8.1 Duration of breastfeeding and LAZ at one year old (Table 10)

In all models, for a month's increase in duration of breastfeeding there was a decrease in LAZ by 0.01 z-score. In model 2 (Model 1 adjusted for gender and ethnicity) compared to being a male, being a female was associated with an increase in LAZ by 0.21. Compared to being white, being from black, coloured and Indian ancestry was associated with a decrease in LAZ by 0.77, 0.67 and 0.54 z-scores respectively. In model 3 (Model 2 adjusted for birth weight, gestational age, symptom score (birth – 1year), disease score (birth- 1 year) household density, water, maternal education, parity and socioeconomic status) ethnicity was no longer associated with a decrease in LAZ. An increase by 1kg in birthweight was associated with an increase in LAZ by 0.82 z-score. Access to better water facilities was associated with an increase in LAZ by 0.27 z-score. An increase by one unit in socioeconomic status score was associated with an increase in LAZ by 0.06 z scores. Gestational age, symptoms, disease, household density, maternal education and parity were not associated with HAZ.

Table 10: Duration of Breastfeeding and LAZ at one year old

	Model 1			Model 2			Model 3		
	β Coefficient	**95% CI Interval**	**p value**	**β Coefficient**	**95% CI Interval**	**p value**	**β Coefficient**	**95% CI Interval**	**p value**
Duration of Breastfeeding	-0.01	(-0.02 - -0.01)	<0.001	-0.01	(-0.02 - -0.00)	<0.001	-0.01	(-0.02 - 0.00)	0.02
Gender									
Male				Ref			Ref		
Female				0.21	(0.11 - 0.32)	<0.001	0.24	(0.11 - 0.38)	<0.001
Ethnicity									
White				Ref			Ref		
Black				-0.77	(-1.04 - -0.50)	<0.001	-0.02	(-0.44 - 0.41)	ns
Indian				-0.67	(-0.97 - -0.38)	<0.001	-0.33	(-0.78 - 0.11)	ns
Coloured				-0.54	(-0.95 - -0.13)	0.01	-0.27	(-0.81 - 0.27)	ns
Birth Weight							0.82	(0.66 - 0.98)	<0.001
Gestational Age							0.01	(-0.04 - 0.06)	ns
Symptoms Score (Birth- 1 Year)							-0.13	(-0.41 - 0.16)	ns
Diseases Score (Birth- 1 year)							-0.41	(-1.04 - 0.22)	ns
Household Density							0.01	(-0.04 - 0.05)	ns
Water									
Poor Access to Water							Ref		
Good Access to Water							0.21	(0.03 - 0.41)	0.02
Maternal Education									
No formal education up to Grade 7							Ref		
Grade 8-10							0.07	(-0.17 - 0.32)	ns
Post School Training							0.02	(-0.31 - 0.35)	ns
Parity							-0.05	(-0.11 - 0.01)	ns
Socioeconomic Status							0.06	(0.01 - 0.11)	0.01

Model 1 is unadjusted (Height for Age at 1 year and Duration of Breastfeeding), **Model 2** is Model 1 adjusted for gender and ethnicity, **Model 3** is Model 2 adjusted for birth weight, gestational age, symptom score (birth – 1year), disease score (birth- 1 year) household density, water, maternal education, parity and socioeconomic status. Significance level: $p < 0.05$, ns- not significant, **Ref**- reference group

3.8.2 Duration of breastfeeding and HAZ at two years old (Table 11)

For a month's increase in the duration breastfeeding there was a decrease in HAZ by 0.02 z-scores in model 1 and then 0.02 in the model 2. In model 3, the duration breastfeeding was not associated with HAZ. In model 2 (Model 1 adjusted for gender and ethnicity), compared to being a male, being a female is associated with an increase in HAZ by 0.25 z-scores. Compared to being white, being black or Indian was associated with a decrease in HAZ by 0.83 and 0.82 z-scores respectively. In model 3 (Model 2 adjusted for birth weight, gestational age, symptom score (birth – 1year), disease score (birth- 1 year) household density, water, maternal education, parity and socioeconomic status), duration of breastfeeding and ethnicity are no longer associated with HAZ. Compared to being a male, being a female is associated with an increase in HAZ by 0.31 z scores. A 1kg increase in birth weight was associated with an increase in HAZ by 0.66 z scores. Compared to having a mother with less formal education (formal education up to Grade 7), having a mother with post school training was associated with an increase in HAZ by 0.32 z-score. Socioeconomic status was associated with an increase in HAZ by 0.07 z-scores. HAZ was not associated with gestational age, symptoms of poor health, disease, household density, and parity.

Table 11: Duration of Breastfeeding and HAZ at two years old

	Model 1			Model 2			Model 3		
	β Coefficient	**95% CI Interval**	**p value**	**β Coefficient**	**95% CI Interval**	**p value**	**β Coefficient**	**95% CI Interval**	**p value**
Duration of Breastfeeding	-0.02	(-0.02 - -0.01)	<0.001	-0.01	(-0.02 - -0.01)	0.001	-0.01	(-0.02 - 0.00)	ns
Gender									
Male				Ref			Ref		
Female				0.25	(0.14 - 0.36)	<0.001	0.31	(0.17 - 0.43)	<0.001
Ethnicity									
White				Ref			Ref		
Black				-0.83	(-1.11 - -0.56)	<0.001	-0.19	(-0.55 - 0.18)	ns
Indian				-0.82	(-1.11 - -0.52)	<0.001	-0.35	(-0.73 - 0.03)	ns
Coloured				-0.39	(-0.82 - 0.04)	ns	0.08	(-0.43 - 0.59)	ns
Birthweight							0.66	(0.51 - 0.80)	<0.001
Gestational Age							-0.00	(-0.05 - 0.04)	ns
Symptoms Score (Birth- 2 years)							-0.05	(-0.32 - 0.22)	ns
Diseases Score (Birth – 2 years)							0.28	(-0.32 - 0.89)	ns
Household Density							-0.02	(-0.07 - 0.02)	ns
Water									
Poor access to water							Ref		
Good access to water							0.10	(-0.07 - 0.27)	ns
Maternal Education									
No formal education up to Grade 7							Ref		
Grade 8-10							0.18	(-0.04 - 0.41)	ns
Post School Training							0.32	(0.03 - 0.61)	0.03
Parity							-0.03	(-0.09 - 0.02)	ns
Socioeconomic Status							0.07	(0.03 - 0.12)	0.001

Model 1 is unadjusted (Height for Age at 1 year and Duration of Breastfeeding), **Model 2** is Model 1 adjusted for gender and ethnicity, **Model 3** is Model 2 adjusted for birth weight, gestational age, symptom (Birth- 2 years), diseases (Birth- 2years), household density, water, maternal education, parity and socioeconomic status. Significance level: $p < 0.05$, ns- not significant, Ref- reference group.

3.8.3 Age at introduction of solids and WHZ at two years old (Table 12)

In all models, age at introduction of solids was not associated with a change in WHZ.In model 2 (Model 1 adjusted for gender and ethnicity), compared to being a male, being a female was associated with an increase of 0.16 z-score in WHZ. Compared to being white, being coloured or Indian was associated with a decrease in WHZ by 0.94 and 0.91 z-scores respectively. In model 3 (Model 2 adjusted for birth weight, gestational age, symptom score (birth – 1year), disease score (birth- 1 year) household density, water, maternal education, parity and socioeconomic status), compared to being a male, being a female was associated with an increase of 0.2 z-score in WHZ. A 1kg increase in birthweight was associated with an increase in WHZ by 0.35 z-score. An increase in the disease score between birth and 2 years of age was associated with an increase in WHZ by 0.89 z-score. Compared to being of white descent, being of Indian and coloured descent was associated with a decrease in WHZ 0.67 and 0.69 z-scores respectively. Gestational age, symptoms of poor health, household density, good access to water facilities, level of maternal education, parity and socioeconomic status were not associated with WHZ.

Table 12: Age at introduction of solids and WHZ at two years old

	Model 1			Model 2			Model 3		
	β Coefficient	**95% CI Interval**	**p value**	**β Coefficient**	**95% CI Interval**	**p value**	**β Coefficient**	**95% CI Interval**	**p value**
Age at Introduction of Solids	-0.01	(-0.05 - 0.03)	ns	0.00	(-0.04 - 0.04)	ns	0.01	(-0.04 - 0.06)	ns
Gender									
Male				Ref			Ref		
Female				0.16	(0.04 - 0.29)	0.01	0.20	(0.06 - 0.35)	0.006
Ethnicity									
White				Ref			Ref		
Black				0.00	(-0.28 - 0.29)	ns	0.37	(-0.03 - 0.78)	ns
Indian				-0.91	(-1.22 - -0.59)	<0.001	-0.67	(-1.09 - -0.25)	0.002
Coloured				-0.94	(-1.38 - -0.49)	<0.001	-0.69	(-1.22 - -0.15)	0.01
Birth Weight							0.35	(0.18 - 0.51)	<0.001
Gestational Age							-0.01	(-0.06 - 0.03)	ns
Symptoms (birth- 2 years)							-0.06	(-0.37 - 0.25)	ns
Diseases (birth- 2 years)							0.89	(0.21 - 1.56)	0.01
Household Density							-0.04	(-0.09 - 0.00)	ns
Water									
Good access to water							Ref		
Poor Access to water							0.13	(-0.07 - 0.32)	ns
Maternal Education									
No formal education up to Grade 7							Ref		
Grade 8-10							-0.02	(-0.26 - 0.23)	ns
Post School Training							-0.09	(-0.42 - 0.23)	ns
Parity							-7.43	(-0.06 - 0.06)	ns
Socioeconomic Status							0.01	(-0.04 - 0.06)	ns

Model 1 is unadjusted (Weight for Height at 2 years and Age at Introduction of Solids), **Model 2** is Model 1 adjusted for gender and ethnicity, **Model 3** is Model 2 adjusted for birth weight, gestational age, symptom score (birth- 2 years), disease score (birth- 2years), household density, water, maternal education, parity and socioeconomic status. Level of significance: $p < 0.05$, ns: not significant, Ref- reference group

3.8.4 Duration of breastfeeding and stunting at two years old (Table 13)

A month's increase in duration of breastfeeding is associated was an increase in the odds of being stunting by 2% in model 1 and 1% in model 2. In model 3, the duration breastfeeding was not associated with stunting at 2 years of age. In model 2 (Model 1 adjusted for gender and ethnicity), compared to being a male, being a female was associated with a reduction in the odds of being stunted by 39%. Compared to being white, being black or coloured was associated with an increased in the odds of being stunted by 2.66 and 2.77 times respectively. In model 3 (Model 2 adjusted for birth weight, gestational age, symptom score (birth – 1year), disease score (birth- 1 year) household density, water, maternal education, parity and socioeconomic status), duration of breastfeeding and ethnicity were no longer associated with stunting. Compared to being a male, being a female is associated was a reduction in the odds of being stunting by 42%. A 1kg increase in birth weight was associated with a reduction in the odds stunting by 70%. A one unit increase in the socioeconomic status score was associated with a reduction in the odds of being stunted by 12%. Gestational age, symptoms of poor health, the presence of disease, household density, access to water facilities, level of maternal education and parity were not associated with stunting.

Table 13: Duration of Breastfeeding and Stunting at two years old

	Model 1			Model 2			Model 3		
	Odds Ratio	**95% CI Interval**	**p value**	**Odds Ratio**	**95% CI Interval**	**p value**	**Odds Ratio**	**95% CI Interval**	**p value**
Duration of Breastfeeding	1.02	(1.00 - 1.03)	0.008	1.01	(1.00 - 1.03)	0.05	1.01	(0.99 - 1.03)	ns
Gender									
Male				Ref			Ref		
Female				0.61	(0.48 - 0.78)	<0.001	0.58	(0.43 - 0.77)	<0.001
Ethnicity									
White				Ref			Ref		
Black				2.66	(1.19 - 5.92)	0.02	0.81	(0.29 - 2.26)	ns
Indian				2.77	(1.19 - 6.42)	0.02	1.14	(0.40 - 3.25)	ns
Coloured				0.48	(0.10 - 2.45)	Ns	0.12	(0.01 - 1.07)	ns
Birth Weight							0.30	(0.21 - 0.43)	<0.001
Gestational Age							1.02	(0.93 - 1.12)	ns
Symptoms Score (Birth- 2 years)							0.92	(0.48 - 1.75)	ns
Diseases Score (Birth- 2 years)							0.79	(0.18 - 3.56)	ns
Household Density							1.05	(0.96 - 1.15)	ns
Water									
Poor access to water							Ref		
Good access to Water							0.79	(0.52 - 1.20)	ns
Maternal Education									
No formal education up to Grade 7							Ref		
Grade 8-10							0.89	(0.56 - 1.41)	ns
Post School Training							0.67	(0.34 - 1.34)	ns
Parity							1.10	(0.98 - 1.24)	ns
Socioeconomic Status							0.88	(0.80 - 0.97)	0.01

Model 1 is unadjusted (Stunting Year 2 and Duration of Breastfeeding), **Model 2** is Model 1 adjusted for gender and ethnicity, **Model 3** is Model 2 adjusted for birth weight, gestational age, symptom (Birth- 2 years), disease (Birth- 2 years), household density, water, maternal education, parity and socioeconomic status. Significance level: $p < 0.05$, ns: not significant, Ref- reference group.

4. Discussion

This section will discuss the results from the data analysis, beginning with the main study findings on the association between infant feeding practices and growth at one and two years of age. Furthermore, the findings from this study will be compared to the findings from previous studies.

4.1 Main findings

In this study, 97.3% of infants were ever breastfed, the mean duration of breastfeeding was 11.6 months and the mean age at introduction of solid and semi-solid foods was 3.6 months. The prevalence of stunting at 1 and 2 years was 8.4 % and 20.5% respectively. The prevalence of wasting at 1 and 2 years was 2.2% and 4.8% respectively.

Overall, the study did observe an association between infant breastfeeding practices and growth at one and two years of age. A significant association was seen between duration of breastfeeding and length/height-for-age z-scores at one and two years of age; infants who were breastfed for a longer duration in time were seen to experience a decrease in length/height-for-age z scores at one and two years of age. It must also be noted that although the association between duration of breastfeeding and height-for-age z-scores at one and two years was statistically significant, the effect was very low as shown by the beta value at -0.01 z-score and -0.01 z-score respectively.

A significant association was seen between duration of breastfeeding and stunting at age two years. The odds of being stunted increased by 1% with a month's increase in the duration of breastfeeding. When this association was tested adjusting for covariates, duration of breastfeeding was no longer associated with stunting; gender, birth weight and socioeconomic status were stronger predictors of better growth outcomes (associated with a decrease in the odds of being stunting).

A marginally significant association between age at introduction of solid and semi solid foods and weight-for-height z scores at two years was observed in the bivariate analysis. The younger the age at introduction of solid and semi solid foods, the lower the weight-for-height z-scores. The effect of the association was very low, as shown by the beta value of -0.05. This association was no longer significant in the multivariate analysis.

There was no association seen between being ever breastfed and any growth indices at one and two years.

4.2 Infant Feeding Practices

4.2.1 Prevalence of children that were ever breastfed aged 0-2 years

The prevalence of children that were ever breastfed in the study was 93.7%. This elevated proportion may represent the percentage of those mothers that initiated breastfeeding but not necessarily how many mothers exclusively/predominantly breastfed their infants for an extended period. This is illustrated by the finding that solid and semi-solids foods are introduced before 6 months of age. In a report by the Department of Health (1998), data indicated that 88% of mothers initiated breastfeeding post-delivery. The high breastfeeding initiation rate in this study (93.7%) measured in 1990 and the most recent prevalence of 88% (UNICEF, 2009) may also be explained by the changing policies on PMTCT which initially in 2001, advised mothers to choose either exclusive breastfeeding with early weaning at 4–6 months or exclusive formula feeding with free infant formula provided until 6 months (Du Plessis et al., 2016). In 2011, the WHO changed infant feeding guidelines for HIV/AIDS infected mothers, encouraging exclusive and continued breastfeeding in both HIV positive and negative .The confusion associated with the change in breastfeeding policy may have led to a reduction in the rate of breastfeeding. In Kwa-Zulu Natal early initiation of breastfeeding increased from 26% in 2011/2012 to 81.6% in 2014/2015 (Spies, 2011; Department of Health 2014). Nevertheless, a recent, review by Rollins and colleagues (2016) showed that early initiation of breastfeeding is compromised in all countries, regardless of their socioeconomic status.

4.2.2 The duration of breastfeeding in children aged 0-2 years old

The Word Health Organization recommends mothers worldwide to exclusively breastfeed their children for 6 months and thereafter begin complementary feeding and continued breastfeeding up to 24 months and beyond (WHO, 2003). The breastfeeding prevalence rate at 12 months was found to be highest in Sub-Saharan Africa (approximately 90%), South Asia and parts of Latin America (Victora at al., 2016). In contrast, a high income country such as the United States reported values as low as 27% for prevalence of breastfeeding at age 12 months (Victora et al, 2016). The average duration of breastfeeding amongst children in this study was 10 months. According to the NDoH (2017), the proportion of children who

are currently breastfeeding decreased with increasing age from 47% in children ages 12-17 months to 19% in children aged 18-23 months (a 28% decrease, indicating that breastfeeding is not maintained. This poor rate of continuation in breastfeeding was illustrated again by the South African Demographic and Health Surveys in 1998, 2003 and 2016, that showed that only 10% , 12% and 28.2% of infants aged 0-3 months, respectively, were exclusively breastfed, while exclusive breastfeeding in infants aged 4-6 months was even lower (1%, 2% and 27.2% respectively) (Ijumba, 2014; NDoh, 2017). The study by Rollins and colleagues (2016) noted that as a country's wealth increases their breastfeeding practices decline and the duration of breastfeeding shortens, possibly accounting for lower prevalence of breastfeeding in higher income countries.

4.2.3 Age at introduction of semi-solid and solid foods in children aged 0-2 years

The WHO (2003), recommends the introduction of solid foods at no younger than 6 months old. The average age at introduction of semi solid to solid foods in the present study was reported to be at 3 months old. A study by Fall and colleagues (2011) looked at infant feeding patterns from five cohorts in low and middle income countries. According to the study, the most frequent age at introduction of complementary feeds was 0-3 months in Brazil, 3-6 months in the Philippines and 9-12 months in India (Fall et al., 2011). The most recent survey reported a prevalence of 7% for exclusive breastfeeding in children under 6 months in South Africa (UNICEF, 2009), in line with results found in several studies conducted in the country. In two different cultural settings in Mpumalanga, South Africa, complementary feeding has been reported as early as 1 month old (Van der Merwe, Du Plessis & Jooste, 2015). This may be due to cultural beliefs; in Limpopo province a food made from maize and roots is given to the infant immediately after birth as an alternative to breastmilk, as it is believed to provide infants with energy to grow well (Du Plessis et al, 2016). A study by Sibeko and colleagues (2005) conducted in township outside of Cape Town, reported that 32% of infants were receiving complementary feeding at approximately 1 month of age. In the study by Sibeko and colleagues (2005), perceived inadequate production of breastmilk and as a consequence the desire to supplement breastmilk was found to be the reasons for early introduction of complementary feeds amongst 90% of the women. Other reasons cited included starting a job, returning to school and the perception that the infant was not fully satisfied by the breastmilk alone (Sibeko et al., 2005). Bland and colleagues (2008) noted a

similar reason for early introduction of solid foods; the concern of mothers was that the infant not being adequately fed and therefore remaining unsatisfied when drinking breast milk only.

4.3 Growth between birth and two years of age

4.3.1 Prevalence of stunting at one and two years

The prevalence of stunting at one year of age was 8.4% compared to a higher prevalence of 20.5% in year two, an increase by 12% between year one and year two. Comparatively the prevalence of stunting in South Africa amongst children age 0-3 years in 1993 was 24.5% (Steyn et al., 2005; Kruger et al., 2012). Surveys published in 1993, 1994 and 2003 showed that rural provinces (Eastern Cape, Northwest Province, Mpumalanga) had a consistently high level of stunting compared to urban provinces (Gauteng, Western Cape) (Said-Mohamed et al., 2015). The most recent stunting prevalence data in South Africa reported the prevalence of stunting in boys and girls under 5 years of age to be 30% and 25% respectively (NDoH, 2017). The highest prevalence of stunting in the age range 0-3 years, was reported in the North West, Free State and Northern Cape and the lowest prevalence of stunting was reported in Kwazulu Natal and most notably in Gauteng (11%). (Shisana et al., 2014). The prevalence in Gauteng is most significant as it is the province which represents the Birth-to-Twenty study population (Shisana et al., 2014). The prevalence of stunting in the age range 0-3 years in Gauteng (11%) in 2014 is an increase from the prevalence reported in this study in 1990-1991 between ages 0-2 years. This confirms that stunting continues to be a public health burden. A systematic review of the prevalence of stunting in South Africa by Said-Mohamed and colleagues (2015) suggests that despite the implementation of the National Strategy (the Integrated Nutrition Programme) in 1995, stunting in children under 3 years of age persist. There have been a drive to scale up national nutrition programmes, which included the implementation of the ‘Roadmap for Nutrition in South Africa for the period of 2013-2017” and the ‘first 1000 days’ approach (Said-Mohamed et al., 2015). It is now important that there be an evaluation on the Roadmap to Nutrition program in order to estimate its success, identify pitfall and adjust accordingly, in order to reduce the prevalence of stunting during the first thousand days of life in South Africa.

As previously mentioned in this study, a 12% increase in stunting between one year of age and two years of age was found. This might indicate that this period of development is a particularly sensitive period and needs to be monitored thoroughly (WHO, 2008). Feeding

practices during this period may also be determinant in the increase of stunting. In addition, in this study an increase in the occurrence of diseases' symptoms and diseases between one year of age and two years of age (see Figures 4 and 5) was noted. This is the period when a child starts walking and is possibly indicating more exposure to environmental contaminants and pathogens (Hubal et al., 2000). This increase of prevalence in stunting could also be explained by an increase in demand of energy (for growth, movement and immune defence for instance) that may not be matched by the nutritional intake. This hypothesis needs to be explored in future study.

In the adjusted analyses, gender (being a female in comparison to being male), birth weight, and socioeconomic status were found to be protective from stunting and infants of Indian or coloured origin had higher odds to be stunted (See Table 10). According to Slemming and colleagues (2017) there are several possible explanation for observed gender differences in the risk of stunting, one of which being that males have been found to grow more rapidly than females (Tanner and Tanner, 1990) and thus being more vulnerable to becoming undernourished (Eriksson et al., 2010). Infant birth weight, in particular low birth weight (<2.5kg) has been established as a determinant of child stunting (Black et al., 2013; Stein et al., 2010) and may also be related to maternal health and nutrition during pregnancy (Martorell and Zongrone, 2012). Higher socioeconomic status had been found to be independently associated with less risks for a child to be stunted across multiple societies and is also a proxy for maternal education (Monden and Smits, 2013; Abuya, Ciera and Kimani-Murage, 2012). Higher socioeconomic status and improved maternal education may lead to improved health-seeking behaviours, improved feeding and hygiene behaviours (Black et al., 2013) and hence a reduced risk of stunting.

The above is also consistent with the reduction in the prevalence of stunting has been noted in parts of Asia, Mexico and South America, particularly Brazil, who associated a reduction in stunting with: increased purchasing power of low-income families, improved maternal education, expanded toilet and water facilities; and the universalization of basic health care, including prenatal care (WHO, 2012).

4.3.2 Prevalence of wasting at one and two years

The United Nations estimate for wasting on the basis of the WHO Child Growth Standards was at 8% globally in 2011, a reported 11% decrease from 1990 (Black et al, 2013). The

prevalence of severe wasting in children under 5 years of age, in Africa specifically was reported at 3.9% in 2005 (Black et al, 2013). In this study, the prevalence of wasting was 2.2% at one year and 4.8% and two years. According to SANHANES-1, the prevalence of wasting for children under 5 years of age in South Africa was 3% in 2016 (NDoh, 2017), a decrease compared to 4.5% in previous national survey in 2005 (Shisana et al., 2013). At a provincial level in South Africa certain provinces still have a high prevalence of wasting, particularly the North West Province (14.7%), Free State (11.5%) and the Northern Cape(13.1) (Zere & McIntyre, 2003; Shisana et al., 2013). The most recent prevalence of wasting in Gauteng was reported at 3.6% (Shisana et al., 2013) similar to the prevalence of wasting in this study, in the same area, more than 20 years later. Wasting puts children at a marked risk of mortality from infectious diseases such as diarrhoea, measles and pneumonia, and has resulted in approximately 800000 deaths in children under 5 years of age (Black et al, 2013). It is clear that wasting remains, though at low prevalence and could probably be eradicated by the identification of the populations at risk and through a reinforcement of current nutrition policies and guidelines in those populations.

4.4 Relationship between infant feeding practices and growth variables

4.4.1 Duration of breastfeeding and height- for- age z- score and stunting

In this study infants that were breastfed for a longer duration were found to have lower length/height for age z scores at 1 and 2 years old.

Using the BT20 cohort, Gitau (2009) whose study focused on complementary feeding from one to two years of age observed an association between breastfeeding and infant growth at year two. There was a reduction in the odds of being stunted in infants that were breastfed for less than 6 months old .The same study found that 96% of infants were introduced to solid foods at less than 6 months old (Gitau, 2009). Using the same cohort, Mthimkulu (1996) described differences in the quality of complementary foods with and without continued breastfeeding. The study described that infants that were still receiving breastmilk at 6 months were less likely to receive energy dense cereals or eggs and infants who were still receiving breastfeeds at 12 months were more likely to receive the maize meal as a complementary food (poor protein content) than those who had stopped breastfeeding (Mthimkulu, 1996). The above suggests that a longer duration of breastfeeding is more likely

to be accompanied by the complement of non-protein rich foods and hence may serve to explain the association between increased duration of breastfeeding and suboptimal growth.

In agreement, a recent study by Mamabolo and colleagues (2004), conducted in Limpopo on infants from birth to age 12 months collected data on infant feeding practices and anthropometry. The study noted an early introduction of complementary feeds, with 17.2 % receiving porridge in the first month of life. A number of other studies have also found that in the urban and rural areas of South Africa infants are introduced to complementary foods at a very early age (Ellison, Wagstaff ,Cameron, de Wet, 1997; Westphal, Phillips, Irwig, 1981;Delport , Becker, Bergh, 1997). The study by Mamabolo and colleagues (2004) suggested that early introduction of complementary feeds, such as maize meal and sorghum, provided the infants with "empty calories"; they were gaining weight due to the high carbohydrate content of the food, however lacking in nutrients and stunting was observed.

The result of this study is in agreement with other studies that described a negative association between increased duration of breastfeeding and child growth (Ng'andua and Watts, 1990; Caulfield et al., 1996, Asenso-Okyere et al., 1997; Brennan et al, 2004; Foraita et al., 2008). Indeed, it has been shown that when infants are introduced to solids at too young an age, there is a possibility of negative effects on infant physical growth (Seward and Serdula, 1984). In a study conducted in Kalafong Hospital in Pretoria by Delport and colleagues (1997), a longer duration of breastfeeding was accompanied by the use of complementary feeds that comprised of poor protein content (e.g. maize meal). Nevertheless, Atsbeha, Nayga and Rickertsen (2015) questioned whether there was a true causal association between an increased duration of breastfeeding and a decrease in height-for-age z-score. The study stated that a negative association between duration of breastfeeding and child growth was found only when they did not control for the adequacy of complementary foods (Atsbeha, Nayga and Rickertsen, 2015). Once the study controlled for adequacy of complementary feeds, duration of breastfeeding had no effect on child growth (Atsbeha, Nayga and Rickertsen , 2015). Therefore the study concludes that adequacy, timing and quality of complementary feeds can create a downward bias on the estimated health effects of prolonged breastfeeding (Atsheba, Nayga and Rickertsen, 2015).

By comparing Birth-to-Twenty results in the early 1990s and recent findings (Mamabolo et al, 2004; Sibeko et al, 2005; Mushapi et al, 2008) it is apparent that poor complementary

feeding was previously noted in the 1990s and that there has been no change a decade later. The above stresses the point that there may be poor knowledge or understanding amongst mothers and other primary caregivers in South Africa regarding the recommendations on infant feeding practices (most notably breastfeeding and complementary feeding practices). It stresses the importance of proper and efficient infant feeding nutrition education and promotion in all communities in South Africa.

4.4.2 Age at introduction of solid and semi-solid foods and weight-for-height z-scores at two years

A marginal association between age at introduction of solid and semi-solid foods and weight-for height z-score was noted at two years in the bivariate analysis; the earlier the age of introduction to solid foods, the lower the weight-for-height z-score. However, this association was not significant in the multivariate analysis.

Multiple studies have suggested varying reasons for this negative association (Delport, 1997; Gitau, 2009; Mamabolo et al., 2004). In a study by Qasem, Fenton & Friel (2015), it was reported that despite the WHO guidelines on breastfeeding and introduction of solid foods, the age range at which solids foods should be introduced is less clear and presents with a "weaning dilemma". Following a period of exclusive breastfeeding, the window of introduction of complementary feeds is a time of vulnerability of the infant in terms of growth (Qasem, Fenton and Friel, 2015). Micronutrient deficiencies can occur during this window of time, in most part, due to the fact that the infant will have higher nutrient demands in comparison to their energy demands (Qasem, Fenton and Friel, 2015). Deficiencies of certain micronutrients may result negative effects on growth and brain development (Lozoff et al., 2006).

A study by Imdad, Yakoob and Bhutta (2011) proposed that a reduction in weight due to early introduction of complementary feeds may be due, in part, to the quality and quantity of education of mothers regarding the practices of preparation and administration of complementary feeds to their infant. A systematic review of the literature showed that educational interventions for complementary feeding had a modest effect on weight and linear growth (Dewey et al., 2008) whereas another review demonstrated that the provision of complementary food with or without nutritional counselling was associated with a significant increase in linear growth (height), most notably in food insecure populations (Bhutta et al.,

2008). These studies indicate that education alone regarding complementary feeding practices has only a small effect on complementary practices.

The key disagreement against early introduction of complementary feeding is the increase in morbidity and mortality amongst infant, most notably in developing countries with poor sanitary conditions (Giugliani and Victora, 2000). The age at which infants are first given complementary feeds may put the child at risk of diarrheal disease from contaminated weaning foods and consequently cause a decrease in weight-for-height (Cohen, Brown and Dewey, 1994). Early consumption of complementary feeds also reduces the intake of breastmilk and consequently infants receive fewer protection factors in terms of their bodies' immunity (Giugliani and Victora, 2000). Complementary feeds may also be a hazardous source of contamination for infants (Giugliani and Victora, 2000). A study conducted in Rio de Janeiro reported that hospitalization rates due to pneumonia were significantly higher in infants who received complementary foods before 6 months of life (Cesar et al., 1999), possibly highlighting that early introduction to complementary foods may cause the infant to be more susceptible to disease and infection. In other developing countries such as Ghana and India, the prevalence of diarrhoea, dysentery and fever was positively associated with complementary feeding in infants aged between 4 and 6 months (Lartey et al., 1999). Nutritional recommendations for infants also include delaying the complementation of certain foods that are highly allergenic e.g. cow's milk which is said to be responsible for 20% of food allergies (Dewey, 2000), causing further adverse reactions, hospitalisation and weight loss.

5. Limitations of the Study

In view of the findings of this study, it is important to consider the following limitations:

- **Missing Data** - Due to the magnitude of a cohort (longitudinal study-participants lost to follow up), the propensity for missing data is much more likely. In this study, I overcame this limitation by running an analysis that compared participants included in the analytical sample (with data on infant feeding practices and growth) to participants without data on infant feeding practices and growth according to their demographic data and birth characteristics. This improved the understanding of whether the participants with data were a true representation of the full cohort.
- **Outdated Data** - This study looks at data from the first two years of the Birth to Twenty Study (1990-1991). I acknowledge that the data is outdated and may no longer be relevant. However, in addition to informing on the complex relationship between infant feeding practices and growth, the rationale of looking at the BT20 data was also to create a baseline of information about infant feeding practices and growth against which current practices can be compared.
- **Broad Definition of Exposure Variables** - The description of the exposure variables in this study (which centred on breastfeeding) needed to be more precise. This study was a secondary analysis, giving the way the data was collected it was not possible to assess exclusive breastfeeding rate or duration.
- **Recall Bias**

  The questionnaires used in this study rely on a recount of practices from the primary caregiver. This may have resulted in recall bias. A change in the caregiver attending the clinic may also have resulted in the recall of incorrect or inaccurate information. This was accounted for in the questionnaires, the same questions were asked repeatedly at different time points in order to account for any inaccuracies.

6. Strengths of the Study

- **Longitudinal Study** - The Birth-to-Twenty Study is a longitudinal study, as such the participants have been followed up over an extended period of time which enriches the data. This also allowed for data on infant feeding practices and growth to be collected at one and two years of age in the 1990s in South Africa.
- **Large Sample Size** – The Birth-to-Twenty Study was a cohort study with a large sample size, which enhances the statistical significance of the study and reduces the chances of random errors.
- **Adjusting for Confounders** – In order to understand whether true association exists between the exposures and the outcomes, one must adjust for confounding variables. This was achieved in the study by running multilinear regressions, hence strengthening the validity of the results.

7. Conclusion and Recommendations

7.1 Conclusion

From this study it can be concluded that there is an association between infant feeding practices and growth at one and two years of age. The results of the study highlight the importance of the quality and duration of infant feeding practices; most notably breastfeeding and age at introduction of complementary foods.

A negative association was observed between duration of breastfeeding and HAZ at one and two years. This study contributes to other studies that noted this association without accounting for the quality of complementary feeds given during the duration of breastfeeding. However, previous studies that looked at the association between complementary feeding and growth using the BT20 data did not find any statistically significant association (Gitau, 2009).

The negative association between age at introduction of solid and semi solid foods and stunting, serves to confirm that children in South Africa in the period 1990-1992 were receiving complementary foods at too young an age and that it may have resulted in sub optimal growth. This information provides a baseline form of evidence and information against which current infant feeding practices and growth can be compared to.

7.2 Recommendations

South Africa presents with a unique contrast in terms of infant feeding practices. This study described a prevalence of 93.7% of ever breastfed children. This is consistent with the study by Victora et al (2016), however exclusive breastfeeding was most recently reported at as low as 32% between 0-5 months (NDoH, 2017). This study (1990-1991) also noted that there has not been much change in the prevalence of stunting and wasting amongst one and two year olds over the past twenty years. There may be two possible reasons for this; *(1)* infant feeding policies and guidelines are not being adhered to or implemented in an accurate manner, *(2)* the variables used to collect data on breastfeeding practices lack sensitivity and specificity.

In light of point *(1)*, it is recommended that further studies be conducted to evaluate the efficiency and effectiveness at which health care workers and the relevant stakeholders are implementing nutritional programs, whether our health care facilities are adhering to nutritional guidelines and policies and if mothers and primary caregivers are receiving quality education on infant feeding practices and adhere to practices. Identify the maternal barriers and enablers for adequate infant feeding practices and particularly exclusive breastfeeding.

In light of point *(2)*, this study used the ever-breastfed variable to determine the prevalence of breastfeeding. While this information is valuable, it highlights an over estimation of the prevalence of breastfeeding as it includes all infant the ever received breastmilk and doesn't account for the quality and quantity of breastfeeding. It is recommended that future studies on infant feeding practices and growth, consider altering this variable to measure breastfeeding and exclusive breastfeeding with more accuracy.

This study highlighted that covariates such as socioeconomic status, level or maternal education, and access to water, household density and ethnicity are implicated in the association between infant feeding practices and growth. It is therefore recommended that further studies be conducted to assess whether there is an association between the above co-variates and growth.

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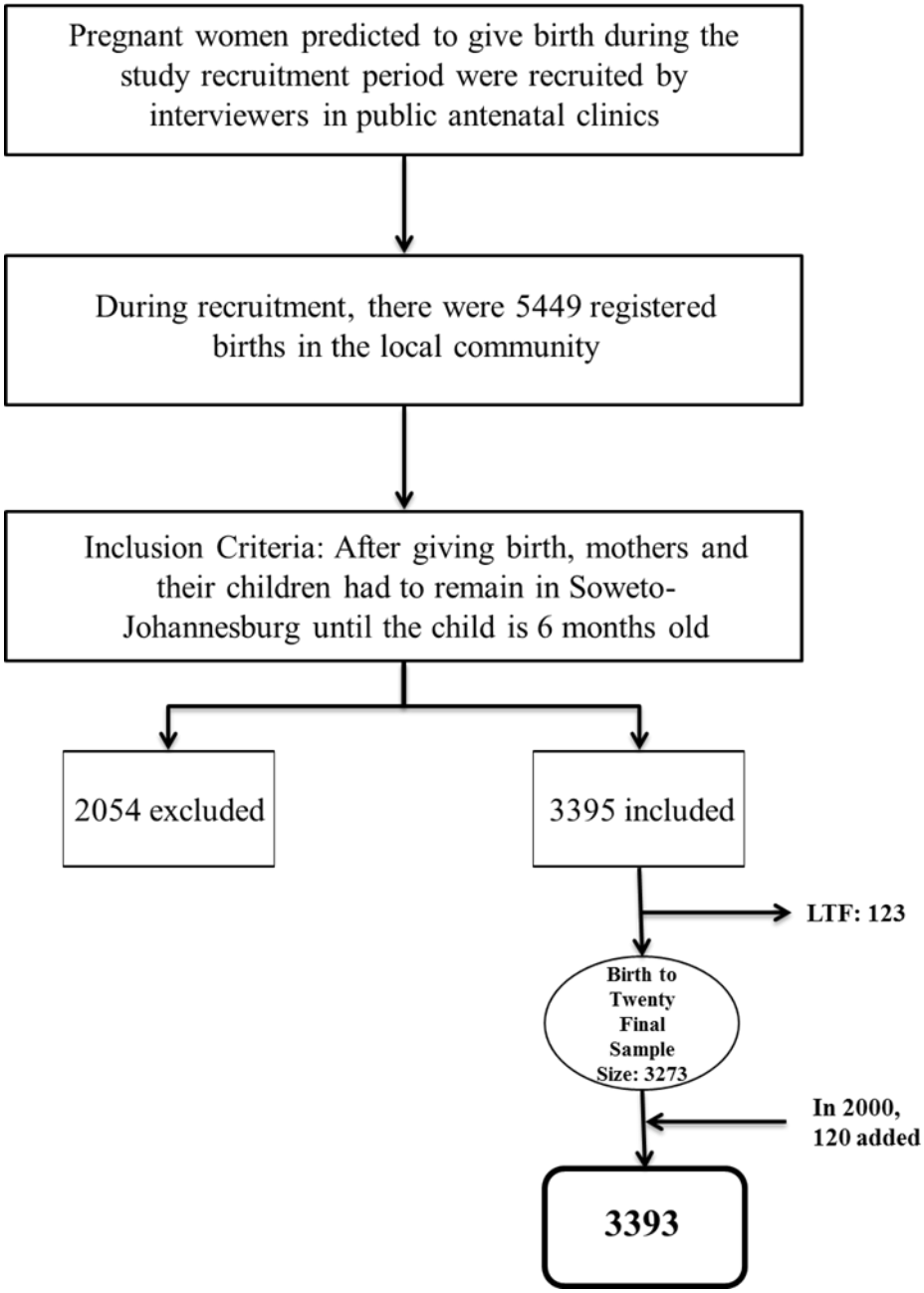
9. Appendices

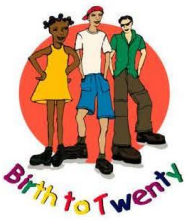
Appendix A: Recruitment of study participants



Flow diagram illustrating the recruitment of study participants in 1989 to 2000, and the enrolment criteria used to getting the final Birth to Twenty sample size

(Adapter from Richter et al., 2007)

Appendix B: 6 Month Core Questionnaire



University of the Witwatersrand
Department of Paediatrics and Child Health

BIRTH TO TWENTY BABIES
6 MONTH CORE QUESTIONNAIRE

DATE: Day ☐☐ Month ☐☐ Year ☐☐☐☐

BTT ID NUMBER: ☐☐☐☐☐☐☐

BONE STUDY ID NUMBER: ☐☐☐

Name of Clinic: _____

Research Assistant name: _____

Language: **Research Assistant:** _____

Respondent: _____

PRIMARY CAREGIVER RELATIONSHIP TO THE CHILD

1. Are you the biological mother/father of this child? ☐

2. If **NO**,
   What is your relationship to the child? *(For example: child's mother's sister, paternal grandmother etc.)*

   ☐ ☐☐

3. Who is the primary caregiver of the child? (*Who lives with the child, who looks after the child most days and nights, and makes decisions around the child?)*

   ☐ ☐☐

6. What is the highest school standard the caregiver has passed?

1 = no formal education	6 = grade 10
2 = grade 1/grade 2	7 = grade 11
3 = grade 3-5	8 = grade 12 (matric)
4 = grade 6-7	9 = post matric
5 = grade 8-9	10 = don't know

☐☐

7. Where has the baby routinely spent most of its time since birth? (please tick)

	With biological mother	**Other**	
		WHOM? (specify relationship and reason)	**WHERE? (physical address)**
During the week day			
Evenings during the week			
During weekends			

8. Has the baby been living in a different place for more than one week?

1 = Yes		**2 = No**	

If YES,

WHERE? (physical address)	**WHOM? (relationship to baby)**	**For how long (in weeks)**

9. What languages is this baby exposed to?

1. _____
2. _____
3. _____
4. _____

☐☐

3

10. What is the highest school standard the baby's maternal grandmother has passed?

1 = no formal education	6 = grade 10
2 = grade 1/grade 2	7 = grade 11
3 = grade 3-5	8 = grade 12 (matric)
4 = grade 6-7	9 = post matric
5 = grade 8-9	10 = don't know

☐☐

11. What is the highest school standard the baby's maternal grandfather has passed?

1 = no formal education	6 = grade 10
2 = grade 1/grade 2	7 = grade 11
3 = grade 3-5	8 = grade 12 (matric)
4 = grade 6-7	9 = post matric
5 = grade 8-9	10 = don't know

☐☐

BIOLOGICAL MOTHER INFORMATION

1. After being admitted for the birth of your baby was there anyone with you during labour or delivery other than the nursing or medical staff?

1 = Yes		**2 = No**	

If **YES**, who was with you?

1.	Father of the baby
2.	Mother
3.	Mother in law
4.	Other family member
5.	Friend
6.	Other: Specify_____

☐☐

2. How many times have you been pregnant?

1.	Total number of pregnancies	
2.	Total number of live births	
3.	Total number of stillbirths	
4.	Total miscarriages/abortions	

☐☐

3. Have any of your children died? (i.e livebirths)

1 = Yes		**2 = No**	

Interviewer's Notes:

- If the biological mother is not the primary caregiver, where is the mother? (Contact details, whereabouts, and reason for not being the primary caregiver)
- Biological mother whereabouts: _____
  _____
  _____
  _____
- Contact details:
  Physical address: _____
  _____
  _____
  Telephone contact 1: _____
  Telephone contact 2: _____
  Telephone contact 3: _____
- Reason for not being the primary caregiver: _____
  _____
  _____
  _____

4. Approximately how much money does this household spend on food per wee

   Most: R_____ Least: _____ Don't know: _____

   Most | | |
   Least | | |

5. Who usually takes care of this child during the day? (eg childminder, relative etc)

   | |

   | |

   If not the mother, for what reason?

   | |

   | |

If **YES**,

a. Did you return to school after having the baby?

1 = Yes		**2 = No**	

b. If you have not returned to school yet, do you still plan to go back to school?

1 = Yes		**2 = No**	

6. Are you living with the father of your child?

Always	**Most of the time**	**Some of the time**	**Not at all**
1	2	3	4

CONTRACEPTION

1. Do you intend having another baby?

Yes	**No**	**Unsure**
1	2	3

If **YES**, when?

Pregnant at present	1
As soon as possible	2
Within 1 year	3
Within 2 years	4
Within 5 years	5
Unplanned (anytime)	6
In the far future (more than 5 years)	7

2. Are you using contraception at the moment?

1 = Yes		**2 = No**	

If **YES**, which type?

Sterilization after delivery	1
Oral contraception	2
IUCD (loop)	3
Injection	4
Condom	5
Diaphragm	6
Spermicidal cream only	7
Withdrawal	8
Rhythm method	9
Abstinence	10
Herbal medicine	11

FEEDING

1. Have you ever breastfed this baby?

1 = Yes		**2 = No**	

If **YES**,

a. Are you still breastfeeding this baby?

1 = Yes		**2 = No**	

If **NO**,

i). How old was your baby when breastfeeding was discontinued?

Months		**Weeks**	

2. Have you introduced bottle feeds?

1 = Yes		**2 = No**	

If **YES**,

a. How old was the baby when you started this?

Months		**Weeks**	

b. At the moment, how many bottle feeds do you give in 24 hours? ☐

c. How much milk per bottle? _____ml

If **YES**,

Age		Cause of death/ symptoms	Year of death
Years	**Months**		
1.			
2.			
3.			
4.			

4. Does/did anyone in the family have difficulty with:

a. Speaking

1 = Yes		**2 = No**	

b. Hearing

1 = Yes		**2 = No**	

If **YES** to any of the above,

Who (relation to baby)	What is the problem
1.	
2.	
3.	
4.	
5.	
6.	

5. When you first realized you were pregnant with this baby, were you still at school?

1 = Yes		**2 = No**	

d. What type of milk are you using?

Powder milk Name: _____		1
Cows milk	Full cream	2
	Skimmed milk	3
Other milk Specify: _____		4

3. Were there any feeding difficulties (eg. Sucking, swallowing, milk coming through the nose) during bottle or breast feeding?

1 = Yes		**2 = No**	

If **BOTTLE FEEDING**,

Which of the following reasons (one or more) did you have for starting bottle feeding?

Going back to work/school	1
Not enough milk or not strong enough	2
Problems with breasts/nipples	3
Difficulty with getting the baby to take the breast	4
Baby preferred bottle	5
Medical reasons (mother or baby)	6
Breast milk did not agree with the baby Specify: _____	7
Mother prefers bottle feeds Specify: _____	8

ADVISED OR INFLUENCED BY:

Father of baby	1
Other relative Specify: _____	2
Friends	3
Health worker Specify: _____	4
Advertising	5
Other	6

If any OTHER reasons, please describe:

_____
_____
_____

4. Have you regularly given your baby food other than milk?

1 = Yes		2 = No	

If YES,

a. How old was the baby when started?

Months		Weeks	

b. What food did/do you give your child?

	Yes	No
Baby porridge/cereal	1	2
Fruit/fruit cereal	1	2
Processed baby food	1	2
Vegetables (home prepared)	1	2
Mealie pap	1	2
Eggs	1	2
Tea	1	2
Other	1	2

If other, Describe

_____

c. If any salt is added to the baby's solids, state how much per day:

None	A pinch	¼ teaspoon	½ teaspoon	1 teaspoon
1	2	3	4	5

5. In the first 2 months, did you feed your baby by:

	Yes	No
Demand	1	2
Schedule	1	2

HEALTH STATUS AND USE OF HEALTH SERVICES

1. Before the birth of this baby, did you receive any antenatal care? (eg visited a clinic/doctor)

1 = Yes		2 = No	

If YES,

a. From whom did you receive antenatal care?

Antenatal clinic	1
Private doctor/obstetrician	2
Other Specify: _____	3

b. How many times did you receive antenatal care? [ ]

c. At how many weeks of pregnancy did you start attending/receiving antenatal care?

[_____ weeks]

2. How long did the mother stay in hospital/clinic after the delivery?

	hours		days

3. How long did the baby stay in hospital after birth?

	hours		days

4. Was there anything wrong with the mother after delivery?

1 = Yes		2 = No	

If YES, what?

_____

_____

_____

5. Was there anything wrong with the baby after delivery?

1 = Yes		2 = No	

9. Is this baby covered by a medical aid?

Yes		No		Don't know	
1		2		3	

10. In the past 6 months, has your child ever had any of the following conditions?

SYMPTOM / SIGN	Yes = 1 No = 2	ACTION TAKEN (tick where applicable)							
		0 = none	1= home remedy	2 = chemist	3 = trad. healer	4 = pvt doctor	5 = public clinic	6 = well baby clinic	7 = hospital
a. Pneumonia (diagnosed by a doctor)									
b. Bronchitis (diagnosed by a doctor)									
c. Asthma (diagnosed by a r doctor)									
d. Other sever chest illnesses									
e. Croup									
f. Wheezing									
g. Runny ears									
h. Eye problems (red/swollen /discharge)									
i. Allergies									
j. Measles									
k. Fits/convulsions									
l. Injuries									
m. Operation									
n. Heart condition									

11. For your usual Well Baby Clinic……

a. How long does it take you to get there?

	hours		minutes

b. How do you get there? _____

c. On average, how much time do you spend there?

	hours		minutes

d.

	Yes = 1	No = 2
In general are you satisfied with the service?		
In general are you happy with the amount of time spent there?		
Have you ever been upset about something that happened to you or your baby at the clinic?		

If YES, specify: _____

ROAD TO HEALTH CARD

1. Do you have your baby's Road to Health Card here with you?

1 = Yes		2 = No	

For interviewer, "MAY I PLEASE SEE IT?"

INFORMATION FROM ROAD TO HEALTH CARD:

Vaccination	Date given	Weight (grams)
BCG / MOPV (polio)	date / month/ year	
DWT 1 / POLIO 1	date / month/ year	
DWT 2 / POLIO 2	date / month/ year	
DWT 3 / POLIO 3	date / month/ year	
MEASLES	date / month/ year	

INFORMATION FROM CLINIC RECORDS

Vaccination	Date given	Weight (grams)
BCG / MOPV (polio)	date / month/ year	
DWT 1 / POLIO 1	date / month/ year	
DWT 2 / POLIO 2	date / month/ year	
DWT 3 / POLIO 3	date / month/ year	
MEASLES	date / month/ year	

2. Why do you have your baby immunized?

_____
_____
_____

HEAD INJURIES

1. Has your baby ever hit its head by:

	Yes	No
Falling from the bed, carrycot or pram	1	2
Falling while being fed, changed or bathed	1	2
Had an object falling on his/her head	1	2
Been hit on the head	1	2
Been involved in a car accident as a passenger while being wheeled/caried	1	2

If YES to any of the above,

a. After the incident, did the child suffer from:

	Yes	No
Loss of consciousness	1	2
Vomiting	1	2

b. What kind of action was taken?

	Yes	No
None	1	2
Home remedy	1	2
Chemist/pharmacy	1	2
Traditional healer	1	2
Pricate doctor	1	2
Public clinic	1	2
Well baby clinic	1	2
Hospital	1	2

PRE SPEECH DEVELOPMENT

	Yes	No
a) Does the child turn immediately towards mother/caregiver's voice?	1	2
b) Does the child babble repetitively? e.g say a-a, muh, goo, atar, er leh	1	2
c) Does the child laugh and squeal aloud in play?	1	2
d) Does the child scream with annoyance?	1	2
e) Does the child cry when uncomfortable or annoyed?	1	2

If YES, what?

_____

_____

_____

6. Was the baby admitted to an intensive care unit?

1 = Yes		2 = No	

If YES, for how long? _____ days

7. Did you go for a check-up yourself (postnatal visit) 6 weeks after delivery?

1 = Yes		2 = No	

8. In the last two weeks (14 days) has your child had any of the following?

SYMPTOM / SIGN	Yes = 1 No = 2	ACTION TAKEN (please tick)							
		0 = none	1= home remedy	2 = chemis	3 = trad. healer	4 = pvt doctor	5 = public clinic	6 = well baby clinic	7 = hospital
a. Sneezing									
b. Runny / stuffy nose									
c. Eye problems (red / itching eyes)									
d. Dry cough									
e. Wet cough									
f. Hoarseness									
g. Difficulty breathing									
h. Noisy breathing									
i. Rapid breathing									
j. Wheezing									
k. Runny ears									
l. Vomiting									
m. Diarrhoea (3 or more loose / watery stools in 24 hours)									
n. Colic									
o. Fever									
p. Poor appetite									
q. Rash									
r. Allergy									
s. Other health problem									

If other, please specify: _____

ENVIRONMENTAL HEALTH

Water, Sanitation, refuse and fuel

1. Does your household have sole us of, share with another household or not have any of the following?

Water	Sole Use	Shared	No Access
Indoor running hot + cold water	1	2	3
Indoor running cold water only	1	2	3
Outside tap only (inside yard)	1	2	3
Street tap	1	2	3
Water from other sources	1	2	3

If you get water from other sources,
Specify nature of source: _____

Type of container used: _____

Is the inside of the container painted?

1 = Yes		2 = No	

2. Access to toilet facilities

Toilet	Sole Use	Shared	No Access
Flush toilet inside the home	1	2	3
Flush toilet outside the home	1	2	3
Pit latrine	1	2	3
Bucket System	1	2	3
Other (specify): _____	1	2	3

If pit latrine/bucket system, how many times on average per month is waste removed?

_____times/month

3. How is your refuse normally disposed of? (please tick all methods used)

Own garbage bin	1
Own refuse heap	2
Communal refuse heap	3
Leaving it in the street	4
Other (specify): _____	5

4. How often is your refuse removed?

Once a week	1
Once every 2 weeks	2
Once a month	3
Hardly ever	4
Never	5

5. What type of fuel do you normally use for cooking?

Electricity (ESKOM or City Power)	1
Own power conductor	2
Coal	3
Gas	4
Paraffin	5
Wood	6
Brazier	7
Other (specify): _____	8

If additional fuel, specify: _____

Is this the same for summer?

1 = Yes		**2 = No**	

If NO, Please specify:

_____

_____

6. What type of fuel did you use fir heating your home during the past winter?

Electricity (ESKOM or City Power)	1
Own power conductor	2
Coal	3
Gas	4
Paraffin	5
Wood	6
Brazier	7
Other (specify): _____	8

If additional fuel, specify: _____

7. Which of the following do you use for heating your home?

	Yes	No
Coal stove	1	2
Wood stove	1	2
Open fireplace	1	2
Primus	1	2
Gas heater	1	2
Electric heater	1	2
Other, specify: _____	1	2

8. Is your home linked to an electricity supply?

1 = Yes		**2 = No**	

Do you currently use electricity?

1 = Yes		**2 = No**	

If NO, why not (please elaborate)

_____
_____
_____

HOUSING

1. Do you have a chimney in this dwelling?

1 = Yes		**2 = No**	

2. Do you have a separate kitchen for cooking purposes only?

1 = Yes		**2 = No**	

3. Is your house painted?

	Yes	No
Inside	1	2
Outside	1	2

If YES to any of the above, is the paint peeling or flaking from the….

	Yes	No
Inside walls / windowsill / doors	1	2
Outside walls / windowsills / doors	1	2

4. Does your home have…..

	Yes	No
A leaking roof	1	2
Cracked walls	1	2
Broken door/s	1	2
Broken window/s	1	2
Anything else that needs repairing	1	2

5. How would you describe the current status of your home?

Good	Fair	Poor
1	2	3

6. Does your house have a ceiling?

1 = Yes		**2 = No**	

7. Do you often find dust to be a problem in your house?

1 = Yes		**2 = No**	

8. What material is your house made of?

_____	1	Don't know	2

9. Have any members of your household done any work on the roof in the last 6 months, which involved cutting or sawing of surfaces?

1 = Yes		**2 = No**	

If YES, were you aware of excessive dust being created by such activity?

1 = Yes		**2 = No**	

10. How old is your house?

Less than 10 years	1
11 – 20 years	2
21 – 40 years	3
More than 40 years	4
Don't know	5

11. Have you had any problems with mould or mildew appearing on the indoor surfaces (walls, ceilings, curtains, etc) of your home?

1 = Yes		**2 = No**	

If YES, Specify

In which rooms?	
What months of the year?	

12. Have you had any problems with leaks or water damage to your home?

1 = Yes		**2 = No**	

If YES, specify

In which rooms?	
When?	

13. In the past month, have you been troubled by?

	Yes	No
Flies		
Rats		
Lice		
Bed bugs		
Cockroaches		

14. Do you have any pets in your home?

1 = Yes		**2 = No**	

If YES,

What pets?	
How many?	

15. How many people live in the place where you stay at present? [ ]

Specify (including and starting with yourself)

	Age	Sex 1 = Male; 2 = Female	Relationship to you
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

16. How long have you stayed at your current address?

	years		**months**

17. Do you think air pollution is a problem in your area?

Yes = 1	No = 2	Don't Know = 3

If YES, what is the problem?

_____

_____

18. Do you think your child's health is affected by air pollution?

Yes = 1	No = 2	Don't Know = 3

19. Are you aware of anything in your house that contains asbestos?

Yes = 1	No = 2	Don't Know = 3

If YES, What?

_____

_____

20. Do you think asbestos in the house can adversely affect you or your child's health?

Yes = 1	No = 2	Don't Know = 3

21. Do you have any comments on asbestos?

_____

_____

_____

22. Are there members in your household who currently smoke?

Yes = 1	No = 2	Don't Know = 3

If YES,

How many? (including yourself)	
How many smoke more than 20 cigarettes per day?	
Don't know	

WORK
MOTHER

1. Are you working now?

1 = Yes		**2 = No**	

If YES,

a)	Describe the job you are doing				
b)	What is your title/position				
c)	What is the name of the company?				
d)	What type of business does this company do?				
e)	Do you work full time or part time?	Part time	1	Full time	2
f)	Do you work shifts or normal office hours?	Normal office hours	1	Shifts	2
g)	Is this the same job you had before you were pregnant?	Yes	1	No	2
h)	How old was the baby when you began working again?	_____ months			

FATHER

2. Is your husband/father of your baby working now?

Yes = 1	No = 2	Don't Know = 3

If YES,

a)	Describe the job he are doing	
b)	What is his title/position	
c)	What is the name of the company?	
d)	What type of business does this company do?	

SMOKING AND DRINKING HABITS

1. Have you ever smoked daily for 6 months or more?

1 = Yes		**2 = No**	

If Yes, do you smoke now?

1 = Yes		**2 = No**	

If Yes, how often?

At least 1 per day	1
Occasionally	2
Not at all	3

2. How often do you smoke alcohol?

Daily	1
Several times per week	2
Once a week	3
Several times per month	4
Once a month	5
A few times per year	6
Never	7

3. Does your husband/partner smoke alcohol?

1 = Yes		**2 = No**	

PIT DEPRESSION SCALE

1. At the present time:

	Yes	No	Don't know
1. Do you sleep well?	0	2	1
2. Do you easily lose your temper?	2	0	1
3. Are you worried about your looks?	2	0	1
4. Have you a good appetite?	0	2	1
5. Are you as happy as you ought to be?	0	2	1
6. Do you easily forget things?	2	0	1
7. Have you as much interest in sex as ever?	0	2	1
8. Is everything a great effort?	2	0	1
9. Do you feel ashamed for any reason?	2	0	1
10. Can you relax easily?	0	2	1
11. Can you feel the baby is really yours?	0	2	1
12. Do you want someone with you all the time?	2	0	1
13. Are you easily woken up?	2	0	1
14. Do you feel calm most of the time?	0	2	1
15. Do you feel that you are in good health?	0	2	1
16. Does food interest you less than it did?	2	0	1
17. Do you cry easily?	2	0	1
18. Is your memory as good as ever?	0	2	1
19. Have you less desire for sex than usual?	2	0	1
20. Have you enough energy?	0	2	1
21. Are you satisfied with the way you are coping with things?	0	2	1
22. Do you worry a lot about the baby?	2	0	1
23. Do you feel unlike your normal self?	2	0	1
24. Do you have confidence in yourself?	0	2	1

POLITICAL VIOLENCE

I would like to ask you some questions about the political/township violence.

1. Have you been personally affected by political violence? (e.g injury)

1 = Yes		**2 = No**	

If Yes, please explain

2. Have you had any difficulty obtaining health care for your child because of political violence?

1 = Yes		2 = No	

If Yes, please explain

3. Has any household member died as a result of violence?

1 = Yes		2 = No	

If Yes, how is the person related to the child?

4. Has any household member been injured as a result of the political violence?

1 = Yes		2 = No	

If Yes, How is the person related to the child?

Who completed this questionnaire?
(e.g mother, maternal grandmother etc)

THANK YOU VERY MUCH FOR YOUR CO-OPERATION

NAMES AND ADDRESSES

MUST BE COMPLETED BY ALL PARTICIPANTS

INFORMATION ON MOTHER

MAIDEN NAME : _____

SURNAME : _____

FIRST NAME : _____

RESIDENTIAL ADDRESS

HOUSE NO. : _____

STREET NAME : _____

SUBURB : _____

ZONE : _____ POSTAL CODE : _____

TELEPHONE: HOME: _____ WORK: _____

INFORMATION ON CHILD

SURNAME : _____

FIRST NAME : _____

RESIDENTIAL ADDRESS

HOUSE NO. : _____

STREET NAME : _____

SUBURB : _____

ZONE : _____ POSTAL CODE : _____

TELEPHONE: DAYTIME: _____

CONTACT ADDRESSES OTHER THAN OWN

1. SURNAME : _____

   FIRST NAME : _____

   RELATIONSHIP TO MOTHER: _____

   RESIDENTIAL ADDRESS

   HOUSE NO.: _____

   STREET NAME : _____

   SUBURB : _____

   ZONE : _____ POSTAL CODE : _____

   TELEPHONE NO. : HOME : _____ WORK: _____

CONTACT ADDRESS OTHER THAN OWN

2. SURNAME : _____

   FIRST NAME : _____

   RELATIONSHIP TO MOTHER: _____

   RESIDENTIAL ADDRESS

   HOUSE NO.: _____

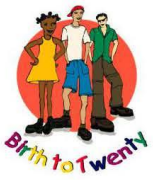
   STREET NAME : _____

   SUBURB : _____

   ZONE : _____ POSTAL CODE : _____

   TELEPHONE NO. : HOME : _____ WORK: _____

Appendix C: Year 1 Core Questionnaire



University of the Witwatersrand
Department of Paediatrics and Child Health

BIRTH TO TWENTY : BABIES
YEAR ONE – CORE QUESTIONNAIRE

DATE : Day ☐☐ **Month** ☐☐ **Year** ☐☐☐☐

BTT ID NUMBER : ☐☐☐☐☐☐☐

BONE ID NUMBER : ☐☐☐

NAMES AND ADDRESSES
MUST BE COMPLETED BY ALL PARTICIPANTS

INFORMATION ON MOTHER

MAIDEN NAME : _____
SURNAME : _____
FIRST NAME : _____
RESIDENTIAL ADDRESS
HOUSE NO. : _____
STREET NAME : _____
SUBURB : _____
ZONE : _____ POSTAL CODE : _____
TELEPHONE: HOME: _____ WORK: _____

INFORMATION ON CHILD (CHILDMINDER'S INFO IF OTHER THAN MOTHER)

SURNAME : _____
FIRST NAME : _____
RESIDENTIAL ADDRESS
HOUSE NO. : _____
STREET NAME : _____
SUBURB : _____
ZONE : _____ POSTAL CODE : _____
TELEPHONE: DAYTIME: _____

CONTACT ADDRESSES OTHER THAN OWN **OR** MOTHER'S POSTAL ADDRESS

1. SURNAME : _____
   FIRST NAME : _____
   RELATIONSHIP
   TO MOTHER: _____
   RESIDENTIAL ADDRESS
   HOUSE NO.: _____
   STREET NAME : _____
   SUBURB : _____
   ZONE : _____ POSTAL CODE : _____
   TELEPHONE NO : _____

CONTACT ADDRESS OTHER THAN OWN

2. SURNAME : _____
   FIRST NAME : _____
   RELATIONSHIP
   TO MOTHER: _____
   RESIDENTIAL ADDRESS
   HOUSE NO.: _____
   STREET NAME : _____
   SUBURB : _____
   ZONE : _____ POSTAL CODE : _____
   TELEPHONE NO. : HOME : _____ WORK: _____

BIOGRAPHICAL

1. Clinic name : _____
2. Name of Interviewer : _____
3. Date of Interview

Day:	Month:	Year:

4. Child's D O B :

Day:	Month:	Year:

5. Child's Place of Birth : (a) Clinic / hospital _____
   (b) Area _____
   (e.g. Crosby, Meadowlands)
6. Did child have any birth complications?
   (e.g. prematurity)

Yes = 1	No = 2

   If **YES**, Please specify :_____ _____
7. Relationship of Interviewee to child : _____

   If **NOT MOTHER**, where is mother?

Work = 1	School = 2	Living away =	Abandoned = 4	Died = 5	Other = 6

8. If **DIED**, how old was baby when mother died?

Months		

9. What was the cause of the mother's death?

_____

10. Who should the BTT letters be addressed to?

Mr	Mrs	Miss

First Name : _____
Surname : _____
Postal Address : _____
Postal Code : _____ Tel. No: _____

11. Who is the responsible decision-maker for the child? (May mark more than one)

1 = mother	5 = brothers / sisters
2 = grandmother	6 = childminder
3 = aunt	7 = friend
4 = father	8 = other

If **OTHER**, please specify _____

12. Mother's age : ☐☐

13. Which BTT activities have you or your child participated in before?

	Yes = 1	No = 2
Antenatal		
Delivery		
Six month		
None		

14. Name of well-baby clinic child usually attends _____

15. Population group of child

Indian = 1	Coloured = 2	African = 3	White = 4	Other = 5

16. Present marital status of mother

Single = 1	Civil marriage = 3	Traditional marriage =	Separated = 5
Divorced = 2	Common law marriage =	Widow = 4	Living together = 6

17. Has mother's marital status changed since the birth of the child?

Yes = 1	No = 2

18. Number of mother's previous live births ☐

19. Number of mother's previous pregnancies ☐

20. Is mother pregnant now?

Yes = 1	No = 2	Don't know = 3

21. If not pregnant, is she using contraception?

Yes = 1	No = 2	Don't know = 3

22. If **YES**, what method is being used?

1 = Pill	4 = Condom
2 = IUCD	5 = Other
3 = Injection	6 = Don't know

23. Who usually takes care of the child during the day?

1 = Mother	2 = Childminder	3 = Relative	4 = Other

24. If **NOT MOTHER**, give reason (e.g. mother works etc.) _____

_____

25. Would you describe where the child lives as

1 = Shack
2 = Flat
3 = House
4 = Hostel
5 = Shared house with another family
6 = Other

☐☐

26. How many people live in this household?

Adults (over 16 years old)		
Others (less than 16 years old)		

27. Is the home where the child lives on a permanent basis -

1 = Owned
2 = Rented from another person
3 = Rented from local authority
4 = Provided by employer

28. Do those supporting the child earn in total between

1 = R 100 – R 300 per month
2 = R 301 – R 500 per month
3 = R 501 – R 800 per month
4 = R 801 – R1000 per month
5 = R1001 – R1200 per month
6 = R1201 – R2000 per month
7 = R2001 – R2500 per month
8 = R2501 – R3000 per month
9 = R3001 – R4000 per month
10 = More than R4000 per month
11 = Not applicable – not working
12 = Don't know

29. What is the occupation of –

Father	
Mother	

30. What is the highest standard mother has passed at school?

1 = No formal schooli	6 = Grade 8
2 = Grade 1 / grade 2	7 = Grade 9
3 = Grade 3 - 5	8 = Grade 10
4 = Grade 6	9 = Grade 1
5 = Grade 7	10 = Matric

SPEECH AND HEARING

31. What language(s) is the child hearing from

Mother	1.	2.	3.
Caregiver	1.	2.	3.
Other (specify)	1.	2.	3.

32. Does your baby try to make sounds e.g. 'ba' or 'da', in such a way that baby sounds happy, cross, excited or as if asking for something?

Yes = 1	No = 2

(**Interviewer** – tick appropriately for **YES** or **NO** – not for each emotion.)

33. Does your baby say anything like

	Yes = 1	No = 2
ba-ba-ba-ba		
pa-pa-pa-pa		
ma-ma-ma-ma		
na-na-na-na		
da-da-da-da		
ta-ta-ta-ta		
ga-ga-ga-ga		

34. Do you or does anyone else do the following with your baby?

	Yes = 1	No - 2
Sing songs		
Sing hymns		
Do nursery rhymes		

BEHAVIOUR BEFORE THE CHILD CAN SPEAK CLEARLY

35. What does the child do when he / she is hungry and sees food?

_____

36. What does the child do when he / she wants food and you won't give it to him / her? _____

37. What does the child do when he / she sees a loved person?

_____

38. Do you know when the child wants something?

Yes = 1	No = 2

If **YES**, what does the child do when he / she wants something (e.g. does the child point to what he / she wants or does the child say anything?

_____

Which of the following do you think the child understands and what makes you think that he / she understands (e.g. responds with waves, nods, smiles, looks up, other)?

DOES THE CHILD UNDERSTAND -

39. when you are saying his / her name?

Yes = 1	No = 2	Response:

40. who his / her mother is?

Yes = 1	No = 2	Response:

41. when he / she hears music?

Yes = 1	No = 2	Response:

42. when you are angry?

Yes = 1	No = 2	Response:

43. what a shoe is?

Yes = 1	No = 2	Response:

44. what a bottle is?

Yes = 1	No = 2	Response:

45. that he / she is going to eat now?

Yes = 1	No = 2	Response:

46. that you are leaving him / her now?

Yes = 1	No = 2	Response:

47. that he / she is going in a taxi / bus?

Yes = 1	No = 2	Response:

48. Is the child saying any words?

Yes = 1	No = 2

If **YES**, please list the words he / she is saying.

1.
2.
3.
4.
5.

49. Can the child copy you? (e.g. you say 'ba-ba' and he / she copies you)

Yes = 1	No = 2

DOES YOUR CHILD HEAR –

50. the dogs barking?

Yes = 1	No = 2	Sometimes = 3

51. the telephone / bell ringing?

Yes = 1	No = 2	Sometimes = 3

52. you calling?

Yes = 1	No = 2	Sometimes = 3

53. noise behind him / her and look?

Yes = 1	No = 2	Sometimes = 3

FEEDING

54. Have you ever breastfed this baby?

Yes = 1	No = 2

55. Are you still breastfeeding this baby?

Yes = 1	No = 2

If **NO**, how old was your baby when breastfeeding was discontinued?

Months	Weeks

56. Have you introduced bottle / cup feeds?

Yes = 1	No = 2

If **YES**, how old was the baby when you started this?

Months		

58. At the moment, how many bottle / cups feeds of milk do you give in 24 hours?

59. How much milk in 24 hours?

	ml

60. What type of milk are you using now?

1 = Powder milk – Name :
2 = Cows milk – full cream
3 = cows milk – skim
4 = other milk – Specify :

61. If any sugar is added to the baby's milk, state how much per bottle / cup.

1 = none	4 = 2 teaspoons
2 = ½ teaspoon	5 = 3 teaspoons
3 = 1 teaspoon	6 = more than 3 teaspoon

62. How old was the baby when started on food other than milk?

Months	

63. If any salt is added to baby's solids, state how much per day.

1 = None
2 = Pinch
3 = ¼ teaspoon
4 = ½ teaspoon
5 = 1 teaspoon

64. Do you usually add sugar to the baby's food (other than milk)?

Yes = 1	No = 2

In the **LAST TWO WEEKS (14 DAYS)**, has your child had any of the following? –

SYMPTOM / SIGN	Yes = 1 No = 2	ACTION TAKEN (please tick)							
		0 = none	1= home remedy	2 = chemist	3 = trad. healer	4 = pvt doctor	5 = public clinic	6 = well baby clinic	7 = hospital
65. Sneezing									
66. Runny / stuffy nose									
67. Eye problems (red / itching eyes)									
68. Dry cough									
69. Wet cough									
70. Hoarseness									
71. Difficulty breathing									
72. Noisy breathing									
73. Rapid breathing									
74. Wheezing									
75. Runny ears									
76. Vomiting									
77. Diarrhoea (3 or more loose / watery stools in 24 hours)									
78. Colic									
79. Fever									
80. Poor appetite									
81. Rash									
82. Allergy									
83. Irritability									
84. Worms in stool									
85. Other health problem									

86. How many regular smokers are there in the house? | | |

87. In the past two weeks, what type of fuel was MAINLY used in child's home?

	1 = none	2 = electricity	3 = coa	4 = gas	5 = paraffin	6 = wood	7 = other
For heating							
For cooking							

88. In the past two months, has the child had to be taken to the clinic, doctor or hospital for an accident or trauma?

Yes = 1	No = 2

89. **RECORDED IMMUNISATIONS**
(Road to Health card or clinic record)

TYPE OF IMMUNISATION	**DATE (insert date in appropriate column)**				
	Birth	3 months	4½ months	6 months	9 months
B C G					
Polio (drops)					
D W T					
Measles					

90. Can you think of anything that has happened to this child since birth that may affect this child's development?

Yes = 1	No = 2

If **YES**, WHAT? _____ and
WHEN DID IT HAPPEN? _____

ARE THERE ANY QUESTIONS THAT YOU WOULD LIKE TO ASK US?

_____
_____

GROWTH DATA COLLECTION FORM

Surname : _____

Name of Child : _____

Name of Mother : _____

Sex : | Male = 1 | Female = 2 |

Health Visitor : _____

Clinic : _____

MEASUREMENTS

Weight (kg)			
Length (mm)			
Head circumference (mm)			
Tricep skinfold (mm)			
Subscapular skinfold			
Relaxed upper arm circumference (mm)			

GROWTH – 3 MONTHS & 6 MONTHS

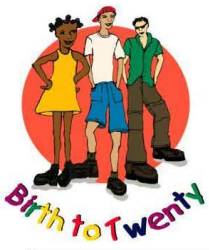
(if available from records)

Weight (kg) – 3 months			
Weight (kg) – 6 months			
Length (mm) – 3 months			
Length (mm) – 6 months			
Head circumference (mm) – 3 months			
Head circumference (mm) – 6 months			
Tricep skinfold (mm) – 3 months			
Tricep skinfold (mm) – 6 months			
Subscapular skinfold (mm) – 3 months			
Subscapular skinfold (mm) – 6 months			
Relaxed upper arm circumference (mm) – 3 mont			
Relaxed upper arm circumference (mm) – 6 mont			

BLOOD PRESSURE MEASUREMENTS

BP 1st measurement			
BP 2nd measurement			

Appendix D: Year 2 Core Questionnaire



University of the Witwatersrand
Department of Paediatrics and Child Health

BIRTH TO TWENTY
TWO YEAR QUESTIONNAIRE

DATE: Day ☐☐ **Month** ☐☐ **Year** ☐☐

BTT ID NUMBER: ☐☐☐☐☐☐☐

BONE STUDY ID NUMBER: ☐☐☐

BTT CHILD'S NAME(S): _____

SURNAME: _____

MOTHER'S NAME: _____

1. Date of birth of child: Day ☐ Month ☐ Year ☐
2. Sex of child: Male ☐ Female ☐
3. Name of clinic : _____
4. Is interview conducted in home language of caregiver? Yes ☐ No ☐

   If **NO**, what language is used? _____
5. Address where BTT correspondence should be sent :

   _____

   _____

6. Contact telephone numbers - Home: _____
Work: _____
Cell : _____
Neighbour: _____
Relative: _____

RELATIONSHIP OF BTT CHILD TO CAREGIVER – If you are talking to the mother of the child (i.e. the answer to question 7 is YES), skip question 8 to question 16 and continue with question 17. If not, continue with question 8.

7. Are you the mother of the child? Yes ☐ No ☐

If **YES,** go to **Q17**

If **NO,** what is your relationship to the child? Specify _____

8. If child not cared for by mother, why not? (e.g. mother works; gone back to school, died etc.)
_____
_____

9. If mother died, how old was BTT baby when mother died? (in months) ☐☐

10. What was the cause of mother's death? _____
_____

11. Where is BTT child cared for?

Child's home	Childminder's home	Creche or similar facility	Other
1	2	3	4

If **OTHER,** specify _____

12. If **CHILDMINDER,** is she / he being paid? Yes | No

13. How old is the childminder? ☐

14. What is the highest educational qualification of the childminder? ☐

15. How many children are in childminder's care? ☐

16. How many different childminders (other than mother) has child had since birth? ☐

BTT CHILD'S HOME ENVIRONMENT
I would like to ask you a few questions about the child's accommodation, as well as the environment where the child stays.

17. During the past two weeks, where and with whom did child spend most of the time?

	Where	Who – relationship to child
a. during the day		
b. during the night		
c. on the weekend		

18. Would you describe where BTT child lives now as

Shack in squatter area	1	House	5
Shack in backyard	2	Hostel	6
Brickroom in backyard	3	Shared house with another family	7
Flat	4	Other (specify)	8

19. Has the home (accommodation) of BTT child changed during the past year? Yes | No

If **YES,** where did child previously live?

Shack in squatter area	1	House	5
Shack in backyard	2	Hostel	6
Brickroom in backyard	3	Shared house with another family	7
Flat	4	Other (specify)	8

20. Is the home where BTT child lives on as permanent basis

Owned by family	1
Rented from another person	2
Rented from local authority	3
Provided by employer	4
Other (specify)	5

21. How many rooms in BTT child's home are used for sleeping? ☐

22a. How many -

Adults **(16 years and above)**	
Children **(less than 16 years)**	

live in the BTT child's home?

22b. What is the **relationship** of the adults and children living in the **BTT child's** home to the BTT child? (including **mother, father, brothers, sisters, cousins, mother's sister or brother, father's sister or brother, mother's father or mother, father's father or mother**, etc.)

FIRST NAME & SURNAME	RELATIONSHIP TO BTT CHILD
1.	
2.	

3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	

BTT CHILD'S PARENTS
I would like to ask you a few questions about the BTT child's parents i.e.the people presently responsible for raising the child

23. How often does the BTT child have contact with his / her **biological father**?

Daily = 1	Weekly = 2	Monthly = 3	Never = 4	Other = 5

If **OTHER,** specify how often _____

24. In the past year, who was mainly responsible for the material support of the child? **(who provides)**

25. What is the occupation of -

BTT child's father / mother's partner?

BTT child's mother?

26. Present marital status of mother –

Civil marriage only	1	Single	5
Traditional marriage only	2	Divorced	6
Both civil & traditional marriage	3	Widow	7
Living together	4	Separated	8

27. Has the marital status of the BTT mother changed since the birth of the BTT child? | Yes | No |

If **YES,** what was mother's marital status at time of birth of BTT child?

Civil marriage only	1	Single	5
Traditional marriage only	2	Divorced	6
Both civil & traditional marriage	3	Widow	7
Living together	4	Separated	8

28. What is the BTT mother's highest educational qualification? _____

29. What is the BTT father's highest educational qualification? _____

30. Has the BTT child's mother gone back to school of continued her education since the BTT child's birth? | Yes | No |

If **YES,** what is she studying? _____

31. Number of live births of BTT mother (**including BTT child**) _____

32. Does BTT child have any younger brothers or sisters? | Yes | No |

If **YES,** specify ages of children in **months**

Child 1	months
Child 2	months

33. Is BTT mother pregnant now? | Yes | No | Don't know |

If **YES,** due date (**month**) _____

34. Has BTT mother used any contraceptives during the past year? | Yes | No | Don't know |

If **YES,** which contraceptive/s presently being used?

Pill = 1	IUCD = 2	Injection = 3	Condom = 4	Other = 5	Don't know = 6

If **OTHER,** specify _____

BTT CHILD' HEALTH
I would like to ask you a few questions about the BTT child's health

ACCIDENTS

35. In the **PAST YEAR** has the BTT child been involved in any accidents (**including home injuries like burns or poisoning**) resulting in injuries? (**Accept mother's assessment re significance**)

Yes	No

If **YES,**

Age (months)	Type of accident	Injury

36. Following the accident, where was the child treated? _____

ILLNESS (excluding accidents)

37. In the **PAST YEAR** has the BTT child been admitted to a hospital or a clinic? (**including a driproom**)

Yes	No

If **YES,**

Age (months)	Duration (days)	Reason (Illness)

38. In the past **TWO WEEKS,** has the child been sick?

Yes	No

If **YES,** what was the problem?

	No = 0 Yes = 1 D/K = 2	Duration in days	ACTION TAKEN (please tick) (1) Home Remedy	(2) Chemist	(3) Trad. Healer	(4) Private Doctor	(5) TPA Clinic	(6) Well-Baby Clinic	(7) Hosp-ital
Sneezing									
Runny / stuffy / blocked nose									
Red eyes									
Watery eyes									
Wet cough									
Dry cough									
Hoarseness									
Fast breathing									
Difficulty breathing									
Noisy breathing									
Wheezing									
Runny ears									
Vomiting									
Diarrhoea (3 or more loose watery stools in 24 hours									
Colic									
Fever									
Poor appetite									
Allergy									
Irritability									
Worms in stool									
Other health problems									

If **OTHER,** please specify _____

39. Since birth, has this child ever been diagnosed by a doctor as having the following :

Bronchitis / bronchiolitis	1	Croup	4
Pneumonia	2	Measles	5
Asthma	3	Other (specify)	6

40. Since birth has child had **for most days & nights for at least 3 months)**

Wheezing / whistling chest	Yes	No
Coughing	Yes	No

41. On the whole, would you say the health status of your child is

Poor = 1	Fair = 2	Good = 3

FEEDING OF THE BTT CHILD
I am going to ask a few questions about breast and bottle feeding, as well as questions about the BTT child's salt and solids intake

42. Did you ever breastfeed the BTT child? Yes | No

If **YES,** do you still breastfeed this baby? Yes | No

If **NO,** how old was your baby when breastfeeding was discontinued? ____ weeks or ____ months

43. Did you ever bottlefeed the BTT child? Yes | No

If **YES,** how old was your baby when you started to bottlefeed? ____ days or ____ weeks or ____ months

44. Do you still bottlefeed the BTT child with milk? Yes | No

If **YES,** how much milk do you give in 24 hours? How many

Cups	Small bottles	Large bottles

45. If bottlefeeding, what type of milk are you using now?

1	Powder milk – name
2	Cows milk – full cream
3	Cows milk – skimmed
4	Other milk – specify
5	Milk combination - specify

46. At what age did child start having foods other than milk? ____ months

47. If any salt added to baby's solids, please estimate how much salt you add per day

None = 1	Pinch = 2	¼ teaspoon = 3	½ teaspoon = 4	1 teaspoon = 5

PSYCHOLOGICAL ASSESSMENT

DEVELOPMENTAL ASSESSMENT
I'd like to ask you some questions about how your baby is developing and about the things you might have noticed he / she is already doing or maybe not yet doing because he / she is still too young

48. In general, are you happy with your child's development up to this stage? | Yes | No |

If **NO,** why not _____

49. **INTERVIEWER OBSERVE IF THE CHILD IS ABLE TO WALK WITHOUT HELP** | Yes | No |

If YES, proceed with NEXT QUESTIONS. If NO, go to NEXT SECTION.
I am going to ask you some specific questions about what you have noticed your child being able to do and what he / she can't yet do. Can your child or is your child able to ……. Mark YES, NO or NO OPPORTUNITY (NOP = either the child does not have the facilities necessary to demonstrate the item or the caregiver has not had the opportunity to observe if the child is able to perform it or not)

IS YOUR CHILD ABLE TO –

50.	Chew solid foods, like meat or bread?	Yes	No	NOP
51.	Take off his / her socks or shoes without help?	Yes	No	NOP
52.	Pour water from one cup or tin into another without spilling and does he / she enjoy doing things like that?	Yes	No	NOP
53.	Overcome simple obstacles, like climb onto chair to get something he / she wants, push open a closed door, use a stick or an implement etc.?	Yes	No	NOP
54.	Fetch something you ask him / her for or go and call someone when you ask him / her to?	Yes	No	NOP
55.	Drink from a cup or glass without help?	Yes	No	NOP
56.	Walk by him or herself (not being carried) if you go to a nearby place, at least some of the way?	Yes	No	NOP
57.	Play with other children i.e. get on with other children?	Yes	No	NOP

58.	Eat soft food with a spoon?	Yes	No	NOP
59.	Walk around the house or yard without you worrying that you have to watch him / her all the time?	Yes	No	NOP
60.	Know what is edible and what is not, i.e. does he / she know not to eat dirt and things like that?	Yes	No	NOP
61.	Use the names of some familiar objects (not people) like blanket, shoes etc.?	Yes	No	NOP
62.	Walk (not crawl) upstairs without help from others (even if child holds onto wall or steps with both feet on each step)?	Yes	No	NOP
63.	Unwrap a sweet or other food that is wrapped in paper?	Yes	No	NOP
64.	Use short sentences and not just single words when talking?	Yes	No	NOP
65.	Ask or tell when he / she needs to go to the toilet?	Yes	No	NOP
66.	Play by him / herself without you looking after him / her, at least for short periods?	Yes	No	NOP
67.	Take off his shirt or her dress by him / herself if the buttons or zips have been undone?	Yes	No	NOP
68.	Get a cup or mug of water without help?	Yes	No	NOP
69.	Dry his / her hands after you have washed them?	Yes	No	NOP
70.	Avoid simple dangers like not touching hot things or sharp knives?	Yes	No	NOP
71.	Put on own dress or shirt without help if you do the buttons or zip?	Yes	No	NOP
72.	Tell you about things that have happened to him / her or tell simple stories?	Yes	No	NOP
73.	Walk downstairs, with one foot at a time on each step?	Yes	No	NOP
74.	Play or do things with other children of same age, like sing a song, say a rhyme or play a simple pretend game, like having tea?	Yes	No	NOP
75.	Put on own shirt or dress and do up the buttons without help?	Yes	No	NOP

76.	Help with little things around the house, like run errands, pick up things, help to set or clear the table?	Yes	No	NOP
77.	'Perform' for others like doing stunts, singing, saying rhymes and so on?	Yes	No	NOP
78.	Wash hands without help and dry them?	Yes	No	NOP

PSYCHOLOGICAL ADJUSTMENT
I'd now like to ask you about any problems you might be having with your child, for example is he / she :

79.	Toilet trained during day – for stools & urine?	Yes	No
80.	Dry most nights	Yes	No
81.	Difficult to manage, throws temper tantrums, is over-active, destructive or uncontrollable?	Yes	No
82.	Passive and inactive, sits around doing little, staring?	Yes	No
83.	Cries, whines, moans and seems unhappy or complains of aches & pains a lot of the time?	Yes	No
84.	Plays with and is liked by other children?	Yes	No
85.	Fearful, won't separate from mother and has other specific fears?	Yes	No
86.	Eats poorly and has a poor appetite?	Yes	No
87.	Seems clumsy, knocks things over, walks into things and trips frequently?	Yes	No
88.	Speech is difficult to understand, speaks badly for his / her age?	Yes	No
89.	Sleeps badly, wakes frequently during the night requiring attention?	Yes	No
90.	Are there any things which haven't been mentioned about your child's behaviour and which bother you?	Yes	No

If **YES**, what are they _____
_____

ASSESSMENT OF HOME ENVIRONMENT
I'd like to ask you a few questions about your home & household activities, especially with regard to your child

91. About how much time each day do you manage to spend 'just playing' with your child?

No time = 0	Less than 1 hour = 1	More than 1 hour = 2

92. How often does his / her father (or other men important to the child) spend time playing with him / her?

Almost never = 1	At least once a week = 2	2 – 4 times a week = 3	Every day = 4

93. About how often do you take your child out of the house with you, to go to the shops, visiting etc.?

Almost never = 1	At least once a week = 2	2 – 4 times a week = 3	Every day = 4

94. Is there anything you are trying to teach your child at the moment? Yes | No

If **YES,** describe _____

_____

95. Does your child have any playthings, bought toys or things you have made or given him / her to play with? Yes | No

96. Is there a radio in the house? Yes | No

97. Does anyone in the household own a motor vehicle? Yes | No

98. Is there a refrigerator in the house? Yes | No

99. Is there a washing machine in the house? Yes | No

100. Is there a telephone in the house? Yes | No

101. Is there a television in the house? Yes | No

102. If there is no television in the house do you and / or your child watch at the house of a neighbour or friend? Yes | No

103. Does anyone in the household bring home a newspaper most days? Yes | No

104. Do you have any pets? Yes | No

105. Do you grow any potplants in the house? Yes | No

106. Do you ever try out new recipes that you hear or read about? Yes | No

RATING OF MOTHER / PRIMARY CAREGIVER (<u>Interviewer</u> should complete the following questions)

107. Does the child look clean and well looked after?

Very clean	1
A bit grubby, but normal	2
Dirty and neglected looking	3

108. Does the child appear happy, confident and secure in the mother's presence?

Completely happy	1
A little insecure, but normal	2
Not happy, confident or secure	3

109. Does the mother seem unhappy and worn down by worries and troubles?

Not at all	1
A little care-worn, but normal	2
Unhappy and worn down	3

110. Does the mother demonstrate any negative feelings towards the child?

Not at all	1
A little, but normal	2
Demonstrates negative feelings	3

111. Does the mother appear to be confident and assured in her care and management of the child?

Very much so	1
A little hesitant, but normal	2
Unsure & lacking in confidence	3

112. Does the mother show affection towards the child?

A lot	1
A little, but normal	2
None, absence is marked	3

SMOKING, SNUFFING AND CHEWING TOBACCO
I would like to ask you a few questions about smoking, snuffing and chewing tobacco by you, your partner or any other members of the household where the BTT child spends time (two or more hours per day

113. Have you ever smoked daily for 6 months of more? | Yes | No |

114. Do you smoke now? | Yes - daily | Yes - occasionally | Not at all |

If **DAILY**, how much do you usually smoke per day?

	No.
Manufactured cigarettes	
Hand-rolled cigarettes	
Pipesful of tobacco	
Cigars	

115. Do you use snuff? (Taken by mouth or nose)
| Yes - daily | Yes - occasionally | Not at all |

If **YES**, how many tins per week? | a week |

116. Do you chew tobacco? (Also known as '**promping**' or '**pruim**')
| Yes - daily | Yes - occasionally | Not at all |

If **YES**, how much per week? | cm / inch |

117. If your partner lives in the same house as the BTT child, does he smoke?
| Yes - daily | Yes - occasionally | Not at all |

If **YES**, how many cigarettes does he smoke per day? | a day |

118. Do any other members of your household smoke regularly? **(excluding your partner)** | Yes | No |

119. All together, how many regular smokers are there in the household **(including yourself)** | |

120. Does any person who looks after the child for two or more hours per day smoke? **(including the childminder)** | Yes | No | Don't know |

FUEL AND WASTE

121. During the **past two weeks**, have you noticed a lot of refuse and rubbish lying around outside your house or in the street? | Yes | No |

122. Is your home wired up for electricity? | Yes | No |

If **YES**, what is electricity used for? Specify _____

_____

123. In the **past two weeks**, what type of fuel was **MAINLY** used in the home of the BTT child?

	None	Electricity	Coal & wood	Gas	Paraffin	Wood only	Other
For heating							
For cooking							

Is there any specific thing that you expect from the study and / or do you have any questions or comments you would like to make? _____

_____

_____

_____

_____

INTERVIEWER: Do you have any comments about the interview?

_____

_____

_____

_____

WE WOULD LIKE TO THANK YOU VERY MUCH FOR PARTICIPATING IN THE TWO YEAR INTERVENTION.

Appendix E: Ethics Clearance Certificate

R14/49 Miss Jenna Snoyman

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M160376

NAME: (Principal Investigator)	Miss Jenna Snoyman
DEPARTMENT:	Paediatrics
PROJECT TITLE:	Infant Feeding Practices and Growth at 2 Years Old in the Birth-To-Twenty Cohort
DATE CONSIDERED:	01/04/2016
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Rihlat Said Mohammed

APPROVED BY: Professor P Cleaton-Jones, Chairperson, HREC (Medical)

DATE OF APPROVAL: 08/04/2016

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 10004, 10th floor, Senate House/2nd Floor, Phillip Tobias Building, Parktown, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in March and will therefore be due in the month of March each year.

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES